SCIENTIFIC AMERICAN

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The Crowd About the Airship After It Alighted in Central Park.

The Airship Just Before the Start, Showing the Rudder.

Knabenshue Returning to the Starting Point. Guiding the Airship Over the Fence.

KNABENSHUE'S AIRSHIP AND ITS EXPLOITS.—[See page 181.]

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NEW YORK, SATURDAY, SEPTEMBER 2, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

MANEUVERING POWER OF TURBINE STEAMSHIPS.

Gradually the disabilities under which the steam turbine labored at its first introduction are being removed; and, when we bear in mind that the practical steam turbine is still in its youth, it must be confessed that the development to perfection is very rapid. The latest success is recorded in connection with the new channel steamer "Dieppe," which has recently been built by the London, Bright and South Coast Company, in association with the Western Railway of France. These two companies having in view the supposedly poor maneuvering qualities of vessels driven by the steam turbine, decided, in placing the contract for the new steamer, to impose exceptionally severe conditions in the starting and stopping tests. A clause was placed in the contract requiring that, as part of the acceptance trials, the boat must be required to pass a certain mark at a given speed and be brought to a state of rest before passing a second mark boat placed at a specified distance from the first boat. The conditions were considered to be so onerous that there was considerable difficulty in getting a bidder, the contract finally being placed with the Fairfield Company. The two mark-boats were moored at a distance of 100 meters, or 109 yards, and the steamer passed the first boat at slightly over the specified speed of twelve knots an hour. The turbines were at once reversed, and the steamer stopped and began to go astern a few yards short of the second mark-boat. It is stated that the time taken in coming to a full stop was 40 seconds. This is an excellent performance for a vessel driven by screw propellers, and places the turbine steamer well on a par in respect of its stopping ability with those driven by reciprocating engines.

In this connection it is gratifying to observe that the value of turbine propulsion for commercial vessels is beginning to be recognized by our steamship companies; for in addition to the turbine steamer recently ordered for a steamship line running between this city and Boston, the Southern Pacific Railway has recently ordered a freight and passenger steamer for the Morgan Line, whose motive power will consist of Curtis turbines. The new vessel will be of considerable size, with a length over all of 440 feet, a beam of 53 feet, and a loaded displacement of about 10,000 tons.

STEEL CARS AND SAFE TRAVEL ON STEAM RAILROADS.

The time has certainly come when the steam railroads of this country should commence systematically to remodel their rolling stock, at least as far as the passenger cars are concerned, and this remodeling should take the form of the introduction of the all-steel car whenever new equipment is ordered. From whatever point of view we look at it, the all-steel is superior to the wooden car. It is stronger, stiffer, and if it be made with careful attention to the design, lighter. It is pre-eminently safer for the passenger, for it simply cannot be telescoped; and it is absolutely fireproof. When the New York city subway was opened, the management had the foresight and courage to adopt the all-steel car boldly as its standard type. It took courage to do this, for it was the common impression that steel cars would be far more noisy than those built of wood, and it was generally believed that such cars would be stiff and formal in appearance, and would not lend themselves to successful interior work. The popularity of the Subway steel cars and their general behavior in service have fully justified their introduction in the Subway. If anything, they are less noisy; they certainly run with greater steadiness; and, for our part, we confess that perhaps because of their hygienic appearance they give an impression of greater cleanliness. The Subway people are so well pleased with them that, as fast as the steel cars arrive, the wooden type is being withdrawn, and before long there will not be a wooden car left in the whole system. It goes without saying that the strongest recommendation of the steel car is the great protection it affords to life and limb. During the Subway strike it was demonstrated in certain collisions that occurred between trains made up of alternate steel and wooden cars that the energy of the collision was expended in crushing up the wooden cars, those built of steel coming through the ordeal practically intact.

The loss of life in collisions on steam railroads has been due chiefly to the telescoping of the cars and the subsequent fires that have broken out in the wreckage. Yet, although in a collision between two all-steel trains both of these prolific causes would be eliminated, it must not be supposed that the passenger would run no risk whatever. The comparative immunity from injury of the passengers in the rear part of a colliding train is due to the fact that the momentum of the rear cars is absorbed gradually in crushing up the forward part of the train. The wooden mail cars, baggage cars, and day coaches act as a cushion or buffer. In a collision between two all-steel trains, however, the shock would be comparatively evenly distributed throughout the whole length of the train, and motion would be, even in the last car, almost instantly arrested, unless, indeed, as might well happen, the cars mounted upon one another or slewed around crosswise of the track. The effect on the passengers would be to hurl them forward in their own cars until they fetched up against seats, partitions, or furniture, with a velocity not much less than that at which the train was traveling at the instant of collision. There would undoubtedly be many broken limbs and painful contusions; but there would be none of that horrible laceration which now occurs when the splintered timbers of a telescoping car shear their way through the crowded mass of passengers.

In building the all-steel day coach, special attention will have to be paid to the method of attaching the cross seats to the floor of the car. The supports must be of good tough steel, thoroughly well bolted through to the steel floor. Otherwise, if the present rather flimsy supports and fastenings were used, the sudden arresting of motion would tear every seat, with its occupants, loose, and cause the huddled mass to sweep forward along the floor of the car to fetch up against the front of the car, with disastrous effects to life and limb.

RAILROAD HOUSEKEEPING ECONOMIES.

The housekeeping side of a great railroad is generally kept in the background, and the annual expenditures and income from this source seldom figure in the year's balance sheet which the public sees in print. Under the general heading of "minor income and expenditures," however, there appear items which might well excite the interest and amusement of the casual student. Whatever else may be said about our great railroad systems, good or bad, they have never been accused of lack of careful, systematic operation in the expenditures of the great sums of money which must annually be made for efficient maintenance. There is no stricter and better business school from which a young man or woman can graduate than one of the great trunk railroad systems which criss-cross our continent in all directions.

A single railroad system will have upward of four or five hundred stations along its different routes, which must be supplied with certain household articles and utensils for good housekeeping. Every modern railroad appreciates the value of clean, sanitary stations, and these temporary stopping places for the traveling public are kept in better condition each succeeding year. Greater comforts and luxuries are supplied by rival roads, and the expenditures in this direction are directly noticeable in the increased patronage.

The "general housekeeper" of a great trunk railroad line is most frequently a man, and his business is to manage the stations, supplying them with all needful articles, and closely watching the waste to see how a saving can be effected. Under his bureau control there come numerous items of apparently small concern, but which in the aggregate amount to considerable sums. For instance, on the Santa Fé system last year, the "general housekeeper" purchased and distributed 26,000 brooms to keep the stations and offices of the company clean. Twenty thousand boxes of soap, 25,000 scrubbing brushes, and a similar number of hand-mops figured in the expenditures. The housekeepers of the individual stations and offices represent a formidable army. Upward of 10,000 of these were employed off and on last year by the Santa Fé road. At many of the small stations, the agent is his own housekeeper, ticket seller, telegrapher, and general freight agent; but at the larger stations scrubbers and cleaners are employed by the year.

The employés and officials of a big road must have pens, ink, paper, and even pins. Last year the pin item on the Santa Fé was no inconsiderable one. The total weight of the pins bought by the general housekeeper and distributed to the employes was 3,000 pounds. Forty thousand pens were also used, and fifty barrels of ink. There were enough lead pencils used to reach from Chicago to New York, and half way back again, if they were placed end to end.

An interesting question that comes up in every household is the disposition of the waste. The railroad housekeeper is careful to study out any economy, and the waste along the whole line is economically disposed of. Waste pins, pens, paper, old brooms, mops, bottles, and worn-out machinery of locomotives are gathered up along the route and sold for junk or "old scrap."

A small item, one would say, but a large one when considered in its true light. From waste paper alone last year the railroad above realized a profit of $5,000. Pens, shingles, and nails proved of important value. The total value of the "scrap heap" reached the enormous sum of $1,250,000. Of course the greater part of this waste came from the worn-out locomotives and cars which are sent to the scrap heap after they have ceased to be of further value to the company. But on the small household items mentioned, upward of $100,000 were realized. Everything is saved, and everything is economically disposed of. Even the ashes are sold or utilized for improving the roadbed.

The equipment of stations to-day with slot machines, literature, and restaurants has greatly increased the labors of the housekeeping department. In some instances the concessions are sold to private companies, but on some roads the rights to sell articles along the route are retained by the transportation company. On the Santa Fé route last year $11,500 were taken in the penny slot machines for chewing gum. This meant that a million and more pennies were dropped into the machines.

The supply of literature by the railroad company is enormous. Upward of five thousand train boys hawked the periodicals through the cars as licensed sellers, and half as many more sold books and magazines at the different stations. Several million dollars were taken in last year on the Santa Fé through this source. The distribution of literature over the whole route is a matter of exact business routine, which is managed entirely by a single head.

Candies, fruit, sandwiches, and similar edibles for the delectation of the travelers are important items. One trunk line annually sells over its route half a million pounds of candy, nearly twice as many sandwiches, and upward of 500 tons of fruit. This does not include what is sold in the waiting-rooms and restaurants of the stations. Here probably as much more of the sweet things are disposed of to hungry passengers.

A million bottles of soft drinks is the annual bill of one road, or rather the amount that thirsty passengers dispose of while waiting for trains. The restaurants on a large trunk line will use upward of fifty carloads of provisions in the course of a year. But these are distributed so generally and gradually that they never block the line of traffic.

The tendency of the public to eat, drink, and read while traveling is so steadily on the increase that more conveniences are being made to satisfy it in this direction. Traveling libraries have become features of the leading parlor cars, and patrons of the road can read their favorite authors or magazines without expense. The traveling café and dining car are as common to-day as the smoker or baggage. To supply these thousands of cars, with all the necessary provisions and articles of diet to suit the most fastidious, the general housekeeper in charge of this department buys in wholesale quantities all along the line. A single railroad system will use upward of 50,000 barrels of flour a year for the dining-car service, 40,000 pairs of poultry, 10,000 quarters of beef, and innumerable tons of fruits, pastry, coffee, and vegetables. To be at the head of such an extensive housekeeping department, a manager must buy economically, and dispose of the surplus and waste profitably. Fruits and vegetables out of season in the North in winter are generally purchased in the South and taken aboard the northbound trains at the most convenient point, and northern fruits and vegetables in summer are likewise shipped south in the same way. Thus all the delicacies of the country are used in and out of season at the lowest minimum of cost.

If we should add to the general housekeeping economics of a railroad the items which pertain more distinctly to the gardening or landscape department, we should find more interesting statistics. Every railroad has its landscape gardening department to-day, and tens of thousands of plants, trees, and shrubs are planted and cultivated every season. One eastern road puts out nearly a million bedding plants every season to decorate the grounds around the stations, and another raises cut flowers so that every office and important station is supplied with fresh-cut flowers every day through the summer season. Ten thousand cut flowers are weekly distributed for table decoration on the dining cars. It costs money to support this department, but the indirect results are apparent in the approval, and increased travel, of patrons.

The care of the linen of a single trunk line is a gigantic task. No hotel or series of hotels offers any

comparison. The napkins and table linen for the dining service of one road mount up into the tens of thousands, and the towels and bed linen for the sleepers represent nearly as many more separate articles. The annual wash of the sleeper and dining-car service amounts to an expenditure of $25,000, although it is nearly all done by steam and machinery. To keep up the supply of linen upward of ten thousand separate pieces of linen are purchased annually. On the great transcontinental trunk lines more money is spent on the table and bed linen than on such apparently important articles as car brackets for hats and coats or upholstered cushion seats for passengers. Yet so careful is the system that every napkin, towel, table-cloth, sheet, or pillow case must be accounted for, and not one can be lost without some adequate explanation accompanying the report of its disappearance. Strict business principles prevail throughout the whole department.

THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The clear evenings of autumn give us a good chance to study the heavens, which at this season are very full of interesting things.

The fine summer constellations, with whose outlines we have become familiar in the past few months, are now in the western and southwestern sky. Arcturus is low in the west, about ten degrees above the horizon at our regular time of observation (9 P. M. in the middle of the month). Above it are the other stars of Boötes, then the semi-circle of Corona and the "keystone" in Hercules, and higher still shines the superb white star Vega. Scorpio is vanishing in the southwest, and Mars (which is at present in this constellation), will soon set. Sagittarius, with the Milk Dipper, is still well seen.

The Milky Way in this constellation, and higher up in Aquila and Cygnus, is one of the finest hunting-grounds in the heavens for a small telescope. It is full of star-clusters and nebulæ—some of them visible to the naked eye—and abounds with magnificent telescopic fields, thickly spangled with stars.

The bright star on the meridian, rather more than half-way up to the zenith, is Altair. It is flanked by a fainter one on each side. The line of these three stars points downward to a pair of small stars, which are the brightest in the inconspicuous constellation of Capricornus. Both these stars are double, the upper one being resolvable with the naked eye, while the lower one requires a field-glass. East of Altair, at the same altitude, is the little lozenge-shaped constellation Delphinus, sometimes called "Job's Coffin." Above this, right overhead, is Cygnus, one of the finest of the constellations, abounding in double and variable stars, and other objects of interest.

About half-way up the eastern sky is Pegasus, which may be recognized at once by the "great square," composed of four second-magnitude stars, which has no counterpart in the heavens. This is a very large constellation, extending westward almost to Delphinus. The star at the northeastern corner of the square, however, does not belong to it, but is known as Alpha Andromedæ. From this star a line of bright stars, about equally spaced, extends to the northeast. The first of these, Beta Andromedæ, serves as a pointer in finding the great nebula of Andromeda. This lies a little above the second of two small stars which form a line extending up from Beta. It is easily visible to the naked eye, but the largest telescopes do not show in it anything like the detail which is shown on long-exposure photographs.

Gamma Andromedæ, the next star in the line, is a very fine double star, the brighter component being red, and the fainter one green. They are much too close together to be divided with a field-glass, but can be well seen with a small telescope. The green companion is itself a very close double, separable only by powerful instruments. Still following the line of bright stars, we come to Perseus, and beyond it to Auriga, whose brightest star, Capella, has just risen in the extreme northeast. Above Perseus, in the Milky Way, is Cassiopeia, and Cepheus fills the gap between this and Cygnus. Ursa Minor and Draco are on the left of the Pole, and Ursa Major is below them, in the northwest.

The southeastern sky is dull. The little triangle which marks the head of Aries is due east, below Andromeda. Pisces, Cetus, and Aquarius fill the large vacant region in the southeast. The last constellation is brightened up at present by Saturn, which is the most conspicuous object in the whole neighborhood. Below it, far toward the horizon, is the lonely bright star Fomalhaut, in the constellation of the Southern Fish.

THE PLANETS.

Mercury is morning star throughout the month. He is best visible about the 15th, when he is at his greatest elongation from the sun, and rises about 4.30 A. M., so that he is easily seen before sunrise. He is in Leo, about 5 deg. southeast of the bright star Regulus, which he much surpasses in brightness.

Venus is morning star in Cancer and Leo, and rises at about 3 A. M. in the middle of the month. She is now about 100 million miles from us, and presents the same phase as the moon does two days after first quarter.

Mars is evening star in Scorpio, setting at about 10 P. M. on the 15th. During the first few days of September he is very near Antares, and it will easily be seen how well the star deserves its Greek name—which signifies *the rival of Mars*—by its resemblance to the planet in color and brightness.

Jupiter is in Taurus, between Aldebaran and the Pleiades, and rises at about 10 P. M. in the middle of the month.

Saturn is in Aquarius, and is well seen in the evening, coming to the meridian about 10 P. M. He is the most interesting telescopic object now visible. A very small telescope suffices to show his rings, and his brightest satellite, Titan. The latter is west of the planet on the 2d, north of it on the 6th, east of it on the 10th, and so on, the period of revolution being about 16 days. In looking for the satellite, the observer should first find out whether his telescope shows objects right side up (as all instruments for terrestrial observation do), or inverts them, as telescopes used exclusively for astronomical purposes do. In the latter case an object that looks east of the planet is really west of it, and so on.

Uranus is in Sagittarius in 18 h. 1 m. right ascension and 23 deg. 42 min. south declination. He is in quadrature with the sun on the 23d, and crosses the meridian at 6 P. M.

Neptune is in Gemini, and rises about midnight.

THE MOON.

First quarter occurs at 11 P. M. on the 5th, full moon at 1 P. M. on the 13th, last quarter at 5 P. M. on the 21st, and new moon at 5 P. M. on the 28th. The moon is nearest us on the 29th and farthest away on the 16th. The time of perigee, when she is nearest the earth, falls very near the time of new moon. We may, therefore, expect unusually high tides about the end of September. The moon's tide-raising force varies with her distance, and when she is in perigee it is nearly 25 per cent greater than its average value. When this happens at new or full moon, when the sun and moon are pulling together, we get very high tides. This year the epochs of such tides happen to fall near the equinoxes; but this is a mere coincidence, which will not occur two or three years hence, and so the high tides which we may expect at the end of this September (and in somewhat smaller measure in August and October, also,) have nothing to do with the equinoxial season.

The moon is in conjunction with Mars on the 5th, Saturn on the 11th, Jupiter on the 19th, Venus on the 26th, and Mercury on the 27th. The conjunctions with Saturn and Venus are fairly close.

On the morning of the 20th there is an occultation of the bright star Aldebaran, visible in the United States. The times and duration of the occultation are different for different places, but in the Eastern States the star will disappear behind the moon's bright limb about 2 A. M. and reappears from behind the dark limb an hour or so later.

At noon on the 23d the sun crosses the celestial equator, and enters the "sign" of Libra and, in the old-fashioned phrase of the almanac, "autumn commences."

LUMBER GRADES.

A subject of increasing importance to every lumber producer and consumer is that of grades. That these grades should be uniform where practical is well recognized, and many efforts to arrive at some general rules have been made. In view of these movements to standardize grades, the Forest Service has undertaken to bring together the specifications of the various lumber and manufacturers' associations and to put them in such a form that they may be compared.

The object of the study is not to devise a system of standard grades, but to make simply such a compilation of the grades now in use as will be of service to lumber producers and consumers, though it is hoped that a great deal of information may be accumulated that will be of value in eventually preparing the way for a standard system.

It is planned to get the views of those concerned partly by interviews and largely by correspondence. A representative of the Forest Service will endeavor to visit the secretaries and members of grading bureaus of various associations and learn their views in regard to the practical workings of the various rules. A large number of mill men and manufacturers will be reached by correspondence and their views sought. It is especially desired to find the important points of difference in grades from the view points of both producer and consumer of lumber, and also to ascertain the chief difficulties in the way of devising and executing a system of standard grades.

The assistance of manufacturers and consumers of lumber is earnestly desired in this work. Suggestions concerning it will be gladly received by the Office of Forest Products, Forest Service, Washington, D. C.

SCIENCE NOTES.

New Rubber-Producing Plant.—The German periodicals describe a new plant which produces a gum similar to caoutchouc. It is a variety of *Landolphia thollonii*. It attains a height of 40 to 50 centimeters, and has numerous roots, from which a juice is extracted containing as much as 18 per cent of gum. It grows in sandy places and will bear drought. It is reproduced by sowing, and when the time of harvest comes, the large roots are cut, leaving the small ones to bud and multiply.

Preparation and Properties of Nitryle Fluoride.—MM. Moissan and Lebeau give, in a memoir presented to the Académie des Sciences, the results of the researches by which they have demonstrated that fluorine does not react at ordinary temperature on nitrous oxide and nitric peroxide, and that it gives with nitric acid a new gaseous compound, fluoride of nitrylé, NO_2F. The density of the gas is 2.24; the fusing point, 63.5 C.; it is endowed with great chemical activity. Although it does not combine, cold, with hydrogen, sulphur, or carbon, it reacts at the ordinary temperature with boron, silicium, phosphorus, arsenic, antimony, and iodine. It decomposes, cold, with production of fluorhydric acid and nitric acid; it reacts on a large number of organic compounds.

Of the cereal crops of this country wheat suffers most from insect depredations. Of the large number of insects which depredate on this cereal, the three important species are the Hessian fly, the chinch bug, and the grain plant-louse, using the latter term to include several allied species which work in much the same manner. The chinch bug is notably a wheat pest, although its damage to other cereals and forage crops is very considerable. The losses from the depredations of this insect on wheat in single States have ranged between $10,000,000 and $20,000,000 in one year. A very reasonable average annual estimate of loss, taking the country as a whole, would be 5 per cent of the value of the wheat crop, which would indicate about $20,000,000 a year chargeable to this insect.

Variable Composition of Firedamp.—M. Lidoff has made exhaustive investigations on mine gas, and has arrived at the conclusion that what is understood by the term "firedamp" is an essentially variable compound. According to Dingler's Polytechnisches Journal, instead of consisting chiefly of methane, it frequently contains 60 per cent of it, while 37 per cent is ethane, and some carbonic acid is present. In many English mines the proportion of methane varies between 77.5 and 98.2 per cent, whereas in the valley of the Donetz it is between 52 and 70 per cent. It cannot be affirmed positively that a small quantity of argon is invariably present, but it is noteworthy that sometimes the gas consists, so to say, merely of carbonic acid.

A Foster Family of Ducks.—A curious experiment in the hatching of ducklings by a turkey was made recently on a model farm at Willerhof, in the outskirts of Schlestadt, in Lower Alsace. It succeeded admirably, as attempts not dissimilar have succeeded elsewhere. The bird was placed in a basket in which were two plaster eggs, and it was kept there by means of a framework. In a couple of days the two artificial eggs were replaced with a dozen duck's eggs. In due time nine ducklings were hatched. The turkey showed much attachment to its brood and protected it devotedly. The first time the ducklings took to the water, the turkey followed them, but soon drew back and patiently awaited their return and its vigilance did not relax even when they had grown up. When the fowl could not share their nest any longer, it left them in the evening to rejoin its fellow-turkeys, but when the coop was opened in the morning, it quickly sought its strange family, all the members of which are in good health.—La Nature.

THE CURRENT SUPPLEMENT.

Mr. Day Allen Willey opens the current SUPPLEMENT, No. 1548, with an interesting article on the new sea-going dredges which have been used for the deepening of the ship channel leading into New York harbor. Mr. R. S. Thompson writes instructively on the possibilities of heating with hot air. How Cognac brandy is manufactured is told in a short contribution. The excellent discussion of reinforced concrete which began in the last number is concluded. Prof. J. Joly writes on the latent image in photography. Wallingford, England, is a place of very considerable interest, although it can show no very striking relics of its former importance. Rev. J. E. Field, however, has managed to tell in an entertaining article much that is interesting about the old town. John S. MacArthur contributes an historical article on gold extraction by the cyanide process. The eclipse of the sun which occurred on August 30 lends peculiar interest to Sir Robert Ball's article on the subject, which is excellently illustrated with photographs. The cause of flower coloration is told simply and clearly by Dr. H. Mandoul.

NATURAL-SIZE PHOTOGRAPHY.

BY CHARLES MONROE MANSFIELD.

The great need by scientific workers of a camera for natural-size photographs, which can be used in the field equally as well as in the laboratory, has at last been realized in the "Graphic Naturalist's Camera." This compact, many-fold camera for making natural-size photographs opens new possibilities to the collector, where the value of the field work depends largely on having the photographs made while the material is still fresh and in its natural condition. Prior to this he had to pin his specimens to a vertical surface and have them hang in an unnatural position with the background filled with distracting shadows. With this outfit the difficulties of vertical photography are overcome and now a freshly-gathered specimen can be arranged naturally on a clean white plate of ground glass and photographed in the field without shadows to mar the beauty of the picture.

Four small chains are attached to the camera in such a way that it may be suspended from the ceiling, doorway, or from a branch of a tree in a vertical position. A strong rubber band is introduced at the junction of the four chains at the point of attachment. This overcomes any vibration, which has hitherto been a drawback to long exposures which are necessary to secure good definition. With the camera so suspended, the lighting is entirely under control of the operator. The ground glass is supported directly on the camera bed, and the entire outfit may be revolved during parts of or during the entire time of exposure, thus obtaining a uniform illumination on the entire subject.

The method of gaining natural size is very simple. The camera is equipped with two scales—one on the back bed and the other on the front bed of the camera. The back of the camera is pulled out to a known point on the scale, and the front is left in place. The double track is racked out to the first reading on the front scale, which is in inches; the ground-glass base is attached to the suspended double track and the camera is in focus for the ground glass. If the subject is 3 inches in thickness the track is racked out 3 inches by the scale, and the subject is then in the right focus. The lens is then "stopped down," and the exposure made. It is not necessary to focus this camera when doing natural-size work, as by setting it at known points the natural size and focus are obtained.

When the camera is being used in the laboratory, where the light can be controlled, it may be supported on a tripod. The head of the tripod and one leg are attached to the bottom (back) of the camera; the other two legs are attached to reinforced metal supports on the inside of the front. This distributes the weight of the camera equally to all three legs, thus making it very rigid.

The camera complete weighs but nine pounds and has a focal capacity of 26 inches. It has all the features of any ordinary camera, such as rising and falling front, front and back swing, and can thus be used for general photographic work as well as for natural-size pictures. This "graphic naturalist's camera" is the invention of Mr. G. N. Collins, of Washington, D. C.

Camera on Tripod.

Camera Suspended by Chains.

NATURAL-SIZE PHOTOGRAPHY.

Protection Against Ants.—Too many recipes can scarcely be tried for this purpose, as many of those already in use are failures. It has been affirmed that recently hosts of these pests have been put to flight by placing in their haunts strips of paper dipped in peppermint oil.—Chemiker Zeitung.

A GIANT DREDGE.

BY OUR BERLIN CORRESPONDENT.

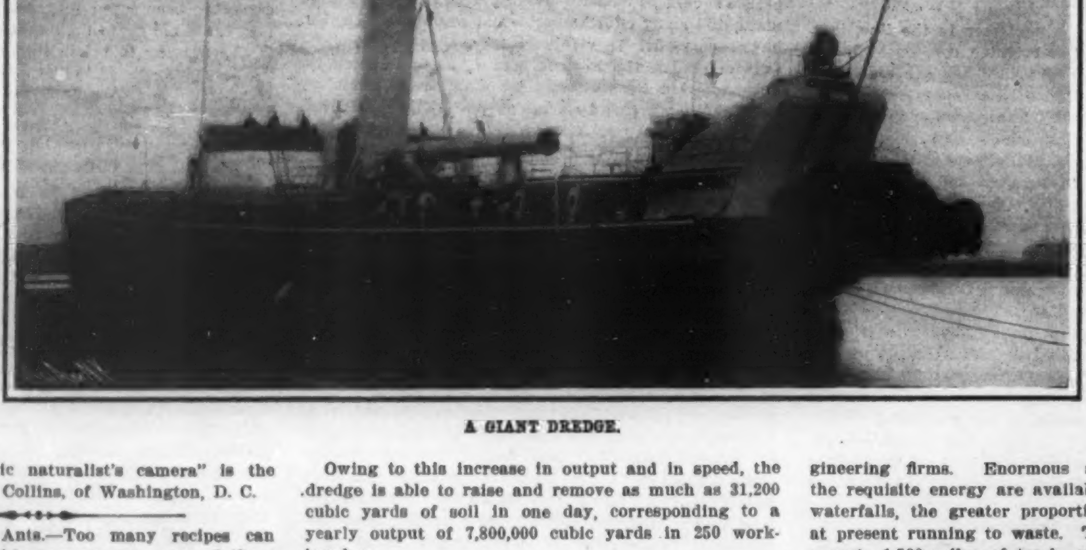
The gigantic dredge represented in the accompanying photograph has recently been completed by F. Schichau, of Elbing and Danzig, Germany, for the imperial navy, and it is intended for maintaining the channel of the Jade River at a convenient depth. The dredges available in the Prussian seaports, up to this time, had proved unable to deal with the Jade channel, which is rather shallow for the new, large-draft German liners.

This dredge, which is the biggest in the world, sailed for Wilhelmshaven after a short test of its engines made at the Danzig shipyards, and in the latter part of December rapidly accomplished its trial dredging with splendid results.

Whereas the contracts called for an hourly output of 4,680 cubic yards in soft ground, the dredge by far exceeded this figure, readily dealing with 6,500 cubic yards per hour instead of 4,680, as stipulated.

In heavy, sandy ground, of specific weight 1.96, the dredge excavated 4,680 cubic yards an hour, 65 per cent of solid ground being raised by the pressure pipes.

As regards the speed stipulated by contract, this had to be 8 knots with full load and tanks pumped full. The mean speed during a run of several hours' duration was, however, 10 knots instead of 8, showing an enormous increase in the performance of the dredge. The coal consumption was extremely favorable, being 0.85 pound per horse-power hour.



A GIANT DREDGE.

Owing to this increase in output and in speed, the dredge is able to raise and remove as much as 31,200 cubic yards of soil in one day, corresponding to a yearly output of 7,800,000 cubic yards in 250 working days.

Each cubic yard of soil raised accordingly costs less than 0.6 of a cent, including allowance for the depreciation of the dredge. This result is quite unique and much more satisfactory than any of the figures so far realized, as the harbor dredges so far known raised each cubic yard of soil at an average cost of 9.6 cents. The Schichau shipyards, we are informed, have secured contracts for a number of these novel dredges, especially for foreign harbors.

Germination and Growth of Artificial Cells.

In a recent memoir presented to the French Academy of Sciences, Prof. St. Leduc, of Nantes, gives a report of some highly interesting experiments, where the germination and growth of the natural cells was reproduced on artificial cells.

A drop of saccharose solution containing traces of potassium ferro-cyanide was introduced into a dilute solution of copper sulphate, when it became surrounded by a membrane of copper ferro-cyanide, pervious to water but impervious to sugar. The cell thus formed was quite analogous to a Traube cell, but for the fact that it possessed the faculty not only of growing but of producing extensions that were quite similar to the radicules and small rods met with in the germination of natural cells.

The physical conditions of a germinating grain in the interior of which there is at the same time a high osmotic pressure and strong cohesion were imitated. In fact, the sweetened and concentrated solution in the interior of the drop would show both a high osmotic pressure and great cohesion, the contact of the potassium ferro-cyanide with the copper sulphate producing the semi-pervious sheath. Under the influence of the difference of osmotic pressure between the drop and the liquid into which the latter was immersed, the water would penetrate through the surrounding membrane, which is impervious to sugar, thus giving rise to the growth of the cell. After a few minutes, there would spring up a bud in some point of the surface, which was surrounded immediately by a copper ferro-cyanide membrane. On the summit of this bud another bud would be produced and on this a third, and so on, each bud representing a cell and the various cells forming a row, which constituted a hollow rod, the length of which could exceed by more than ten times the diameter of the original cell. This artificial cell would absorb in its interior the substance necessary to its growth and by means of which it would produce such a voluminous body. It will be readily understood that the rod-shaped growth is due to the fact that the terminal bud has always the thinnest membrane liable to yield under the increase of osmotic pressure. Sometimes a small drop would be projected in the course of the experiments beyond the original drop, disengaging itself entirely from the latter, and this drop would likewise grow, produce buds, and give off small rods, which would also grow and finally reproduce a body similar to the one this drop had been disengaged from.

The Switzerland government has resolved to convert the whole of the railroads in the country to electric traction and tenders for carrying out the enterprise are to be invited from the most prominent electrical engineering firms. Enormous sources of generating the requisite energy are available from the abundant waterfalls, the greater proportion of which power is at present running to waste. The state railroads aggregate 1,520 miles of track, of which 242 miles are double. Although the revenue from the railroads is already considerable and lucrative to the government, it is anticipated that conversion of the railroads to electric traction will result in an increased profit.

TIME TEST OF A GREAT IRRIGATING SYSTEM.

BY H. A. CRAFTS.

The Turlock and Modesto irrigating systems, covering some quarter of a million acres of land in Stanislaus County, California, are among the most costly and extensive in the country.

They were built and maintained under the Wright irrigation law, and cover two adjoining districts. The Turlock system cost $3,500,000, and has been in operation six years. The Modesto system cost $1,350,000, and is now in its second year of operation.

The two districts joined in the construction of the great diverting dam at La Grange. This dam cost $550,000, and is said to be the highest overflow dam in the world. It is 127 feet high at its highest point, and has an average height of 97 feet.

It is 301 feet long upon its crest. At its base it is 94 feet thick, and at its crest 13 feet thick. Yet long as it is, the Tuolumne River, in which it is situated, has been known to flow over it to a depth of 18 feet.

The dam was built by excavating for a foundation, and then building up a solid rubble masonry wall of rock, each rock weighing from one to eight tons. It contains 40,000 cubic yards of this class of masonry, which was laid in 30,000 barrels of cement. The masonry was faced on both sides of the dam, and had a core of concrete laid in the center to prevent possible seepage.

The ground plan of the dam forms an inverted arch, the crown lying upstream. The upstream side of the dam is vertical, while the lower face has three slopes, varying from one-fourth to one.

The dam was finished in 1893, and within three months after its completion it had 16 feet of water flowing over its crest. It has been put to an equally severe test many times since, but has stood the strain without showing a flaw or a weakness.

The Turlock canal is taken out on the south side of the river, 60 feet above the dam, and starts with a solid rock tunnel 600 feet long and 12 by 15 feet in the open. The Modesto canal is taken out of the north side of the river, just at the dam, and through an open rock cut.

The carrying capacity of the Turlock canal is 1,500 cubic feet per second, and of the Modesto canal 640 cubic feet per second.

For a distance of 22 miles each of these canals traverses the rough and broken country composing the foothills of the Sierra Nevadas before reaching the San Joaquin Valley, where the distribution of water begins; and in this combined distance of 44 miles they present some as difficult problems in irrigation engineering as may be seen anywhere in the country.

The more difficult work was encountered on the Turlock canal, which embraces not less than four rock tunnels and four principal flumes. The tunnels represent an aggregate length of 2,500 feet.

The rock encountered in the first tunnel was of such a hard and flinty nature that three shifts of men working with the best Burleigh drills were enabled to advance the work but 18 inches each twenty-four hours.

But that the more vulnerable parts of the mountain division of the system have not stood the test of time in an entirely satisfactory manner, is evidenced by the fact that this season not less than $75,000 is being expended in making changes and repairs.

As has already been stated, the Turlock canal has seen six years of use, and the principal weaknesses evinced are in the flumes. The largest of these flumes is at Snake Ravine, and is 1,540 feet in length and 13 2-3 feet in width. It was built on mud-sills, and the floor sills and posts are badly decayed.

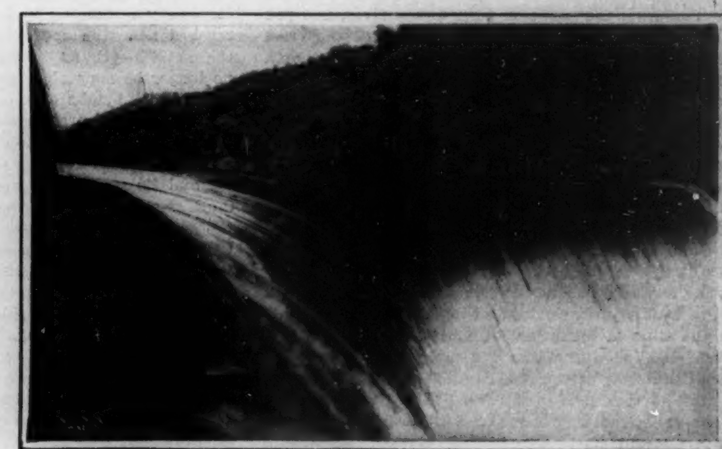
This flume is not to be repaired, but is to be abandoned altogether, and the canal carried around an adjoining bluff on a bench, with an outer retaining wall of masonry. Around this bench the bottom and sides of the proposed canal will be excavated to the depth of about 18 inches, and filled in with good puddle, and then the inner half of the retaining wall will be built up of the same class of material. The cost of this piece of work will be about $25,000.

There are three flumes on high trestles on this upper portion of the main canal. The upper flume, which spans Morgan Ravine, is 300 feet long, and the bottom of the flume is 60 feet above the bed of the ravine. The second is that crossing what is known as Delaney Creek, and is 514 feet long and 61 feet above the bed of the creek.

The third is that crossing Peaslee Ravine, and is 350 feet long and 64 feet above the bed of the ravine. Some 200 feet of the Delaney Creek flume collapsed during the season of 1904, just in the busiest part of the irrigating season, and resulted in heavy damage to a large percentage of the crops under the system.

The part going out was immediately replaced with fluming of the same character, and the old part is being replaced with new this season; while the flumes across Morgan Ravine and Peaslee Ravine will be taken out, and their places supplied with triple, inverted siphons of steel pipe, 6 feet in diameter. These changes will involve a cost of about $45,000.

Fifteen-Foot Concrete Drop on the Modesto Canal.



Flood Tide at the Great La Grange Dam. Eight Feet of Water Going Over Dam.

Wash and Regulating Gates of Turlock Canal.

A Flume on Turlock Canal Joining a Rock Cut.

TIME TEST OF A GREAT IRRIGATING SYSTEM.

Calcium Steel.

A novel material, likely to assume a high importance for the ceramical industries in case the statements made in regard to its properties are borne out even partially, is called "calcium steel." This product is obtained from feldspar sand and a lime flux and is a compact, homogeneous, and plastic mass of great hardness, resisting oxidation and not affected by the influence of the atmosphere or of acids; it also is a poor conductor of heat and electricity. Its specific weight is 3.2, and its crushing strength about 2,500 kilogrammes per square centimeter. "Calcium steel" can be worked like a metal, and can be filed, bored, chiseled, polished, enameled, painted on, or otherwise decorated like glass and porcelain. For the manufacture of articles from this product two processes are available. After mixing the two components, viz., feldspar sand and lime, in the proper ratio and in a finely-powdered condition, the mass can either be molded cold and compressed like bricks and the articles thus obtained heated up to the temperature required for the combining of the components, or else the mass may be simply melted together and poured out like metal in molds after having become liquid. The cast articles would have to be carefully annealed and cooled slowly.

Calcium steel is of a white color but can be colored by the addition of metal oxides or the like. Its extremely favorable physical properties make it an excellent material for water conduits, gas pipes, and other underground piping.

Gas producers, gas engines, and centrifugal pumps will be used at two of the pumping stations of the New Orleans drainage works to handle the dry-weather flow. The storm water will be pumped by the electrical apparatus already installed, which will be worked intermittently as occasion requires.

RECESSION OF NIAGARA FALLS.

BY ALTON D. ADAMS.

Horseshoe Fall has receded more than 260 feet within the memory of living men, and is now traveling toward Lake Erie at the rate of fully 500 feet a century.

At present the crest of this fall, as its name implies, has the general outline of a horseshoe, and its length is about 3,000 feet, but if the present rate of erosion continues the length of the crest may reach 8,000 feet or more within the next half millennium. Now the Canadian end of the Horseshoe Fall is a few rods upstream from the spot whence Table Rock has fallen into the Gorge, but the indications are that this end of the cataract will gradually retire toward the Dufferin Islands, leaving a bare cliff as the apex cuts its way upstream.

The forces that are operating to bring about these changes have cut the prophecy of their completion in the rock of the river bed. In the earliest known view of Niagara Falls, that of Father Hennepin, published in 1697, the crest of what is now the Canadian cataract, like that of the American, is a straight line. Draw such a line from the spot where the crest of the Horseshoe Fall touches Goat Island, and across the Gorge at right angles to the Canadian bank of the river, and you have the probable approximate location of the crest of the greatest of the three cataracts that Hennepin saw. During the more than three centuries since Hennepin and La Salle first looked on this "great and prodigious cadence of waters," what is now the American Fall seems to have changed but little. Meantime the relatively small cataract, that the picture made by Hennepin shows in front of and flowing at right angles to the Horseshoe Fall, has disappeared so long ago that no living man can remember it, and the latter fall has so changed that Hennepin himself would hardly recognize it if he came back.

The straight line across Niagara Gorge, mentioned above as the probable location of the Horseshoe Fall in the time of Hennepin, measures nearly 1,300 feet from cliff to cliff. From the main New York bank along the crest of the American Fall to Luna Island, a mass of rock that is separated from Goat Island by a slender stream of water, the distance is only 800 feet in a straight line. The picture given by Hennepin shows no break in the crest of the American Fall between the New York bank and Goat Island, and it seems most probable that Luna Island was then a part of the former. With 800 and 1,300 feet, respectively, for the widths of the two larger cataracts seen by Hennepin, his picture of the Falls is very nearly in accord. All this is some evidence that the crest of the Horseshoe Fall in the time of Hennepin was approximately a straight line from the down-stream end of Goat Island to the Canadian bank. From the center of such a line to the present apex of Horseshoe Falls the distance is about 1,300 feet, and so it appears that the fall has receded to this extent during something more than three centuries.

Conclusions based on the apparent size and form of the Falls in the picture of Father Hennepin are in the nature of the case uncertain, but later and more accurate information leads to similar results.

In 1842, the contour of the Horseshoe Fall was determined by the State Geologist of New York, and, in 1890, the contour was again determined by the New York State Engineer. During the forty-eight years between these dates the crest of the Horseshoe Fall at its apex receded some 260 feet upstream. In this recession the apex of the Fall moved not in a straight line, but on a curve, as it had apparently done before, and maintained a nearly constant distance from Goat Island, while receding from the Canadian bank. As located in 1890, the apex of the Fall was about 1,300 feet from the nearest point on the shore of Queen Victoria Niagara Falls Park, and some 700 feet from the bank of Goat Island. If the apex of the Fall continues to cut its way upstream during the next 500 years at the same rate it has gone since 1842, and follows about the same curve, the year 2400 will see it some 2,500 feet nearer Lake Erie, and between the Three Sisters and Little Brother Island on the one side, and the Dufferin Islands on the other. From Little Brother Island the apex of the Fall will then be distant probably 700 feet, or 1,400 feet from Goat Island, and some 2,100 feet from the Dufferin Islands. In order to understand the reasons for the past and probable future movements of the crest of Horseshoe Fall, it is necessary to consider the forces by which the strong hand of the waters is chiseling a narrow channel several hundred feet deep through the strata of rock that underlie the upper river.

Just above Goat Island the width of Niagara River is more than 4,000 feet; between the upper end of the island and the Canadian bank the width is about 3,300 feet; and across the Gorge on a line uniting the ends of the Horseshoe Fall the distance is 1,200 feet. Approximately nine-tenths of the 222,000 cubic feet of water discharged by Niagara River per second is thus crowded into a deep and narrow channel before it reaches the Horseshoe Fall. Along what was supposed to be the deepest part of this channel runs the boundary line between the United States and Canada, fixed by the treaty of Ghent at the close of the war of 1812. Curiously enough at first sight, but for a very good reason, this boundary line coincides nearly with the center of the boiling cañon between the two converging sides of the Horseshoe Fall, and passes 300 feet from its apex. Such is the nature of the bed of the upper Niagara River that the erosion along the crest of the fall increases very rapidly with the depth of the water. This is due to the fact that all of the more rapid erosion takes place not by the gradual wear of the silt and gravel carried by the water, but by the breaking of great chunks of rock from the river bed.

At the bottom of Niagara River, just above the Falls, there is a layer of hard limestone intersected by numerous seams, and below this are layers of shale and other soft rock to a depth of several hundred feet. The limestone crest wears away only slowly as the water rushes over it, but the shale underneath is rapidly disintegrated by the spray and back-wash, so that the face of the cliff behind the Falls is constantly concave. It is this formation that makes it possible to go behind both the American and the Horseshoe Fall. As the overhanging ledge of brittle limestone is thus constantly increasing in length, a point is frequently reached near the apex of the Horseshoe Fall where the great depth and weight of water overhead can no longer be supported, and a large block of the projecting rock breaks off. In this way is the Horseshoe Fall cutting a gorge upstream, and the overhanging limestone naturally breaks away faster and forms the apex of the Fall at the point where the water is deepest and its weight the greatest. Hence, the form of the Horseshoe Fall. At the crest of the American Fall the water is shallow, for it forms only about one-tenth of the entire discharge of the Niagara River, and the channel between Goat Island and the New York bank, about 1,800 feet above the Fall, has a minimum width of only 400 feet, while the clear crest of the Fall is about 1,000 feet long. These conditions, together with the approximately uniform depth of water along the crest of the American Fall, have kept it nearly a straight line, and made its recession very slow.

It now remains to determine some of the results that will probably follow as the apex of the Horseshoe Fall travels toward the first line of breakers some 3,000 feet above the present crest. Niagara River changes its direction by fully ninety degrees at the Horseshoe Fall, and the Gorge just below is gradually being cut to form the arc of a circle, much as that at the Whirlpool was many centuries ago.

When Father Hennepin, in 1679, first saw Niagara, the Horseshoe Fall was just about to begin to make this 90-degree turn; its crest line seems to have been nearly straight, and its probable length was about 1,300 feet, as indicated above. Now the recession of the Falls has more than doubled that length of crest line, by changing it into the horseshoe form, and as the process goes on a long gorge not more than 700 feet wide will be cut in that part of the river bed where the water is the deepest. Thus the edge of the cliff over which the water flows will constantly lengthen, and the average depth of water over the edge of that cliff will approach more nearly to the greatest depth in that part of the river between Goat Island and the Canadian bank. As the volume of water per second that will flow over the edge of the cliff depends on the length of that edge, and on the depth of water above it, and as the actual discharge of the river may be assumed to be constant for this purpose, it follows that the water level between Goat Island and Queen Victoria Niagara Falls Park will be much lowered within the next five centuries. Even the coming century, if the apex of the Horseshoe Fall recedes 500 feet meantime, will see the crest of this fall increased by 1,000 feet, or one-third of its present length, and the water level between Goat Island and Queen Victoria Park will probably be reduced by one to several feet. Before the apex of the Falls reaches a point between Little Brother Island and the Dufferin Islands, the water flowing in front of Queen Victoria Park will be so thin a sheet that it will make nothing but spray in going over the edge of the cliff.

When the Horseshoe Fall has a crest some 8,000 feet long into a gorge that measures 3,500 feet from the apex of the Fall to its lower ends, and not more than 700 feet across between the two facing wings of the cataract, it will present an even more interesting spectacle than it does to-day.

Another incident of this change will be its effect on the great power plants between Dufferin Islands and the present crest of the Fall, along the shore of Queen Victoria Park. Directly in front of and only 700 to 1,000 feet distant from these plants will then be the crest of the Fall, and a great reduction of the water level at their intakes must result. The present stockholders and bondholders in these plants need not be alarmed, however, for long before the changes mentioned can be completed much of the equipment of these plants will have sunk in rust, after having earned, it is hoped, at least a fair return.

Electrical Notes.

The German Atlantic Telegraph Company is just laying out a new telegraph cable between Constantinople and Constanga, on the Black Sea. This cable is to be connected in Constantinople with the existing aerial telegraph lines between Bucarest and Berlin, so that a new direct telegraphic connection is forthcoming between Berlin and Constantinople. In addition to the German-Turkish telegraphic traffic, this new line is to be used for communication between the states of western Europe on the one hand, and Turkey, Asia Minor, and Greece on the other. The new line is supposed to assume a high importance for the economical interests of Germany in Turkey and Asia Minor, while greatly accelerating the transmission of telegrams between Berlin and Constantinople.

In order to prevent wireless messages interfering with one another, endeavors have been made to send electrical waves only in one direction, as luminous signals are given off from a concave mirror. Prof. Braun has been engaged in experiments of this kind, and in a lecture held on July 11 before the Strassburg University Association of Electricians and Naturalists he announced that these experiments had come to successful conclusion. Prof. Braun's methods are based on the fact that three antennæ arranged in the angles of a regular triangle are excited by waves of the same periodicity, but of different phases. The inventor states that one of the three antennæ begins vibrating by 1-250,000 second earlier or later than the two others, this difference in time being kept up, according to experiments, with an accuracy of about one second in three years. This will result in different radiation according to the difference of the space, and by simply inverting a crank the direction of maximum effects can be shifted by 60 or 120 degrees.

A new system of electrically lighting trains is being adopted on certain British railroads. This is the Leitner-Lucas system. It differs from the general Stone type, wherein the electrical energy is generated by an axle-driven dynamo and stored in accumulators, inasmuch that instead of compensating the variable speed of the axle by a slipping belt, there is an automatic decrease of the lines of force cut by the armature windings, by reducing the dynamo field in approximate proportion to the speed of revolution. To attain this end, subsidiary armature windings are mounted on the same shaft as the primary armature, and revolve under small separate fields, thereby becoming a small subsidiary dynamo. This arrangement is carried out in such a manner that the flow of current through the main field is counteracted or choked back by an opposing electromotive force from the small subsidiary armature, which opposing voltage rises proportionately to the speed at which the whole machine is driven. Various methods of winding have been adopted in this system for regulating against sudden rise of current or voltage in the circuit feeding the accumulators and lamps due to variations. The output of the dynamo is kept reasonably constant independent of the train speed.

Among miners, where the underground workings are lighted by electric incandescent lamps, there is often a tendency to be careless in the handling of the lamps. As the light is not naked, it is considered that the lamps may be laid down anywhere without fear or danger. Some experiments that have been carried out in England, however, prove the fallacy of this contention, and show that an incandescent electric lamp is equally as dangerous if not properly handled as a naked light. The investigations of Mr. H. Hall, one of the British government inspectors of coal mines, showed that when a sixteen-candle-power lamp was covered with coal dust, the generation of heat was so rapid that within four minutes a temperature of 450 deg. F. was attained, and the bulb burst. His investigations also showed that when the heat had risen to a certain point evidences of spontaneous combustion developed, and although the lamp was then removed from the coal, heat generation still continued, and finally the coal burst into flame. In another case the investigator imbedded a 100-volt 16-candle-power lamp in a heap of coal dust. Within three minutes smoke was emitted from the dust, and in another case where the lamp was simply laid down upon the heap, flame burst out in the course of twenty-five minutes. Colliery managers should therefore impress upon the miners the great danger, when stopping work for a few minutes, attending the laying down of the lamp upon the ground. It should always be suspended, with the bulb free from contact on all sides. Every care should also be displayed in handling the globes so as to avoid breakage, as the instantaneous exposure of the incandescent filament when the bulb bursts is sufficient to create a violent explosion should any firedamp be present. A short time back a terrible explosion occurred in a French coal mine, by means of which sixteen men lost their lives, owing to the ignition of the firedamp by the bursting of an incandescent bulb.

Correspondence.

A Chance for Inventors.

To the Editor of the SCIENTIFIC AMERICAN:

In the July 29 issue of the SCIENTIFIC AMERICAN there is a short article under the title "The Dangers of Cheap Leather," which is of great interest to many shoe manufacturers of this city. I have had a large experience as a bottom finisher for twenty-five years and for the past two years and one-half have had a large amount of trouble in finishing the bottoms of shoes. The manufacturers are at a loss to remedy the evils that arise from a large majority of the leather now on the market, and would gladly welcome some method whereby the leather generally in use could be finished satisfactorily. The chief trouble is that the bottoms first lose the luster and in the course of from forty-eight hours to three days a white crystalline salt forms on the bottom and renders the bottom unfit. The leather has great absorption power and during the process of manufacturing when wet retains the moisture to a detrimental degree. This is a subject that is of great interest to thousands of shoemakers through New England, and if there is any method or chemical that will remove the preparation that is found in the leather it will be welcomed by both the manufacturers and shoe operatives of New England. Should you desire any samples of the leather I should be pleased to furnish them.

Brockton, Mass., August 14, 1905. C. A. BROWN.

The Reasoning Power of Animals.

To the Editor of the SCIENTIFIC AMERICAN:

As I regard opportunities offered in this column very precious in the settlement of controversies when they frequently arise, I would much appreciate space allowed to explain my position in connection with that fascinating question, "Do animals reason?" as per claims made in your issue of July 22, and again criticised—I believe hastily—in this column August 5. My conclusion that animals and small children do not reason is based on the undoubted fact that when they imitate complex acts which cannot be ascribed to instinct, they come by the necessary mental impulse wholly through subconscious processes. Reasoning, in the popular sense, is supposed to mean judgments born of conscientious mind processes—intellection, in other words. What subconscious mental processes are, we do not as yet pretend to know; but one thing is certain—they exist in both men and beasts, and they always accompany conscious processes. In the former conscious processes dominate the subconscious processes, and we are therefore said to come to the use of reason, while in the latter the reverse exists, and hence we say animals cannot reason. Suffice it to say, therefore, that when the famous cat saw the door opened many times for the same purpose on which was dependent its own welfare also, unconscious writ formed on its brain, of which process it was unaware, thought not consciously, and did not reason. When this impression, stamped there by provident Nature herself, was finally matured and ready to use, it suddenly became conscious to, and was thereafter successfully employed by the cat to imitate human acts to further its own ends. While I still believe the substance of my former argument is self-evident under these circumstances, that the bear is really hoping to find his way out without smashing the heavy iron bars, and that the scope of the imitative mind is very great, as described before, there remains one point requiring careful consideration, and that is that phase of mind we call intuition. My contemporary says: "This is a God-given faculty possessed by only a favored few people, who do not have to stop to reason." Intuition, as I take it, perforce, is at once a special gift and a universal faculty as well. On the one hand, men apparently conceive ideas from a "clear sky," but such genius could not manifest itself were not the mind already highly cultivated by much conscious effort—reasoning—and experience. While on the other hand, animals and small children become conscious of much knowledge by merely witnessing the intelligent movements of others, and in time, without thought or effort on their part, they suddenly discover that they also are competent to do the same thing, or, in other words, they begin to imitate. It is a general impression among psychologists that animals probably do not reason; they have no ideas as we have.

ALBERT F. SHORE.

Brooklyn, N. Y., August 10, 1905.

The Reasoning Power of Animals.

To the Editor of the SCIENTIFIC AMERICAN:

I have been much interested in the discussion in your paper as to the reasoning powers of animals, for I believe, this belief, being based on personal observation, that nearly all animals do possess the power of reason, and that this power is capable of development, depending on the animal's natural intelligence and on its association with man. Not only animals, but, I believe, birds, especially crows and parrots, can and do reason. When I was a boy at home we had several different cats that could open the old-fashioned thumb-latch doors. This was so common among our cats that we thought nothing of it. Two years since I was in Washington County, Pennsylvania, on the farm of Mr. G. A. Hogg. Mr. Hogg owned many pure-bred draft horses—Shires and Percherons. Among the Shires were three two-year-olds, Cremona, Imogene, and Dainty. These, together with several brood mares and other young ones, were in a large hillside pasture. It was my habit to go to them, Sundays, to see how they did, and to take along a bucket of oats, the better to make friends with them, for, like men, the way to a horse's heart is through its stomach. The Shires were naturally more friendly than the Percherons; they would come to me from a distance from which the Percherons would not and so got, each time, the greater part of the oats. After some time Mr. Hogg sent out a three-year-old Percheron, Artless by name. She was put in the pasture, but, contrary to my expectations, would have little to do with those of her own breed, but ran with the Shires. One Sunday I went out, as usual, and had to climb the hill to the top to find the horses. As soon as they saw me the three Shires came up and soon had finished the greater part of the oats, the Percherons meanwhile remaining away at some little distance, in the shade of a clump of walnuts, and paying no attention to me. With them was Artless. After satisfying myself that all were well, I started back down the hill, followed by the Shires. Dainty kept looking in the direction of the Percherons and would stop and whinny earnestly, rather impatiently. This she did five or six times. Before I reached the bottom of the hill Artless came up on the trot—came directly up to me, put her nose in the then empty bucket, and, as much as possible, by looks and actions, said: "Where are those oats Dainty said you had?" I am no scientist, but this demonstrated to me that Dainty wanted Artless to have some of those oats and took pains to inform her that I had some and that she must hurry if she would have them, also that she reasoned how, and had language sufficient to convey this (to a horse) good news. Previous to this Artless had been rather shy and difficult to approach. I would have thought little of it had she been as friendly as the Shires, but she probably had not had a handful of oats since she had been in that pasture and would not come very near me.

It is my opinion that anyone, who has an eye for such things, and who has had experience with horses in our regular cavalry under all conditions, on drill, in the field, in the stables, corrals, and on the picket lines, at target practice, etc., will say that unless horses can reason it would be difficult or impossible to give an explanation of things they do. I believe everyone has witnessed the close friendship that many times exists among animals to others of their own kind, to other animals, and to the principal animal, man. Does it not require a reason and power of reasoning to form such friendship? Or is it all "dumb luck," instinct, and intuition?

I have spoken more particularly of horses, for I have observed them closer than other animals, but, as stated above, it is my belief that all, or nearly all, animals have the power of reason, in different degrees of development, and that education will further develop it same as in man. HARRY S. SIMONS.

Monticello, Ky., August 10, 1905.

GRENADES AND GRENADIERS.

BY LT.-COL. C. FIELD, ROYAL MARINE LIGHT INFANTRY.

One of the most striking points about the determined assaults on Port Arthur by the Japanese and the stubborn and heroic defense of that city by the Russians is the immense variety of warlike appliances that have been called into play by both sides. Some of these, such as electrically charged wire entanglements, represent the *dernier cri* in military art, while others, such as the noxious and poisonous-smelling compositions thrown into the Russian trenches by the Japanese, their bamboo mortars, and the armor shields carried by their pioneers when endeavoring to cut through the entanglements surrounding the forts of the defenders, carry one's thoughts back to quite medieval ages. Hand grenades, which have been practically out of date for a century, have been employed by both sides so extensively that it seems possible that their use and manipulation may enter into the general curriculum of the soldiers training in our own and other modern European armies. Time was when these deadly little missiles were carried by a number of the biggest and strongest soldiers in every infantry regiment, and for many years after they had fallen into disuse the grenadier company, composed of such men and wearing a distinctive uniform, formed the right company in every battalion, just as the light infantry company, containing the smallest and smartest scouts and skirmishers in the corps, formed the left one.

Nowadays the only grenadiers are special regiments, such as our own grenadier guards and other similar *corps-d'élite* in the German, Russian, Belgian, and other armies on the Continent. But as a badge, the grenade is still one of the most favorite ones in the world. With us it is carried by the grenadiers, fusileers, Scots Grays, engineers, artillery, and marine artillery; it is almost universal in the French army, and is far from infrequent in the armies of Germany, Italy, and Russia.

The word "grenade" is a French word, meaning pomegranate, the little hand-thrown shells being about the size of that fruit—about 2½ to 3 inches in diameter. The precise date that these weapons were first invented seems uncertain, but it appears that they were made in large quantities at Arles in 1536. They were used at the siege of Rouen in 1562, and in that of Famagusta, in Cyprus, nine years later. At this period and for a long time afterward, though they seem to have been in pretty extensive use, there were no specially trained companies or regiments of grenadiers. Then, as now, they were specially intended to be used in trenches, at barricades, and at close quarters in narrow streets and passes. Nor was their use confined to the land service, as in December, 1652, we find the ordnance officials of the navy asking for "five thousand hand grenades at 2s. 6d. each." According to one description, the grenade at this epoch had a fuse which consisted of a wooden tube whose sides were perforated with numerous small holes. At the top of this tube was a piece of lighted slow-match with a bullet attached to its lower end. When it struck the ground the weight of the bullet would drag the lighted match into the perforated tube, and so ignite the powder and burst the grenade. To make the missile strike right side uppermost, so that the bullet would drag the match downward, the opening at the top had a bunch of box twigs attached, which acted in the same way as the feathers of an arrow or the stick of a rocket. Possibly the long pyramidal projection which is seen at the top of the grenade worn as a badge by some regiments represents this bunch of leaves, though it is generally supposed to represent the flame issuing from the fuse. In some cases this is very much larger and more spreading, and without doubt represents flames—much more flame than would be seen in reality. The French were the first to establish regular grenadiers, in the year 1667, when four men were selected in each company of the "King's Regiment" for training in the use of hand grenades. In 1670 these men were formed into a grenadier company, which was commanded by M. de Riotor, who thus enjoys the honor of being the first grenadier officer on record. In the same year thirty of the most senior regiments in the French service were also provided with grenadier companies. Eight years later we followed suit in this country, as is recorded in "Evelyn's Diary." He says: "29 June, 1678.—Now were brought into service a new sort of soldiers called 'grenadiers,' who were dextrous in flinging hand grenades, every one having a pouch full. They had furred caps with coped crowns like Janissaries, which made them look very fierce; and some had long hoods hanging down behind, as we picture fools, their clothing likewise piebald—red and yellow." Then, and for many years after, grenadiers carried, besides their bag of grenades, axes, firelocks, dagger bayonets, and swords. After throwing their missiles they were drilled to rush upon the enemy's defenses, ax in hand, on the order "Fall on." At first, our grenadiers wore a certain amount of armor—breastplates, at any rate. At the storming of Aughrim, in 1691, it is related that "the forlorn hope consisted of sixty grenadiers in breastplates." This must have somewhat impeded their activity, and in France, at any rate, as will be seen by the annexed illustration reproduced from a work published in that country in 1696, the grenadiers wore a very easy-fitting costume. In the description which accompanies this plate it explains: "The figure B shows the position in which those throwing the grenade should stand, so that by a single movement and in an instant, turning the back to the place at which it is intended to throw it, it can be done more promptly, for in any other posture at least two or three times as much time is required to throw it, which might be very hazardous to the grenadier." Hand grenades were employed in conjunction with an inflammatory mixture, the two being placed together in an earthenware pot covered with parchment, like a jam-pot, and provided with a fuse and a rope handle. This was then thrown into the enemy's works, the pot broke, the composition blazed up, perhaps started a conflagration, and at any rate igniting the fuse of the grenade, which of course exploded.

The fur caps worn by our first grenadiers before long gave place to cloth ones with a shorter hood. The latter adornment had quite disappeared by 1715, but the front of the cap, which was generally of the color of the regimental facings, was handsomely embroidered. With slight changes this high miter-shaped cloth cap lasted till 1765, when it was replaced by a fur one of a somewhat similar shape. The illustration, taken from an old print, shows a grenadier of 1745 wearing the cloth cap and in the act of throwing his grenade. The words of command at this period were: "Sling your firelocks—handle your matches—open your

fuse—guard your fuse—blow your matches—fire and throw your grenades—return your matches—handle your slings." Such detail one would hardly consider conducive to a rapid rate of fire. By the time the fur cap came into wear the grenadiers had to a very large extent given up the use of the hand grenade, but the grenadier companies were still composed of the biggest and finest men in the different regiments. Toward the end of the eighteenth century it became the custom to form grenadier and light infantry battalions provisionally from these companies of the different regiments employed together on an expedition or campaign. This proceeding, while certainly providing a few battalions of extremely high-class soldiers, must yet have had a bad effect on the force at large, every regiment losing its smartest and best men just when they were most required. In fact, the same evil effects must have been felt as (according to a German critic) were experienced by British infantry during the late Boer war on account of their picked men being drafted to the mounted infantry. "The infantry were then robbed more and more of their better elements. . . . and an increasing demand arose from all sides for mounted troops. So only the elements of least value remained behind with their battalions—men who were bad shots, with but little smartness about them." This must have been recognized before the end of the eighteenth century, for we do not find many instances of the practice in the early wars of the succeeding century.

The pointed fur cap gave place to a larger, round-topped one with a brass plate and glazed peak and adorned with cords and tassels. In 1835 the plainer and bigger fur head-dress, much like what is now worn, but rather higher, came into vogue and has continued with modifications to the present day. At this time, too, it is interesting to note, the Blues also wore the fur grenadier cap. Abroad, the big fur grenadier cap had an extensive vogue in almost all armies, but at the present day the only foreign regiments wearing it are the Belgian grenadiers and gendarmerie, the Russian palace guard, the Danish guards, the Mecklenburg-Schwerin grenadier regiment, the Dutch horse artillery, and a New York veteran association known as "The Old Guard." It may be remarked, however, that the high eighteenth-century miter cap, but with a metal point, is still worn by the First Prussian foot guards, the First Prussian guard grenadier regiment, and the famous Russian Paul regiment of the imperial guard.

As for the grenade itself, the fighting in the Far East has shown it to be, with modern high explosives, a most formidable and destructive weapon, and it is possible that we may yet see a revival of the grenadier companies that gained such renown by their prowess in bygone times.

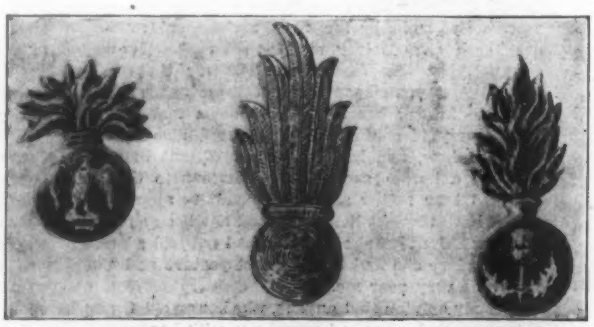
Grenade with loop and cord.

Ordinary Grenade with fuse of slow-burning composition.

Grenade of 1550 with twigs and slow match.

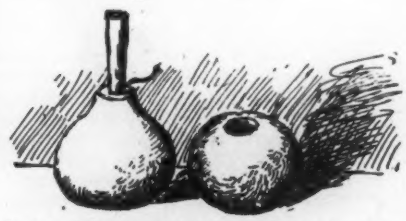
Grenadier Cap Worn 1765-1800.

Grenadier of the 2d Queen's Regiment, 1687.



1.—Royal Fusileers. 2.—Royal Artillery. 3.—Royal Scots Fusileers.

Various Types of Grenade Badges in the British Army.



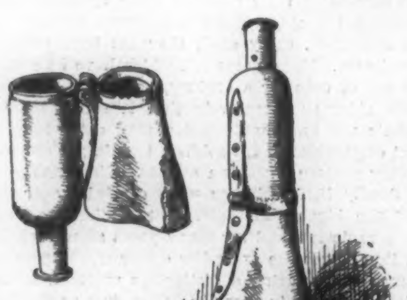
Earthenware Hand Grenade, 1851, closed by hardwood plug having channel for fuse.

Flintlock Musketoon or band-mortar for discharging hand-grenades, with support.

French Grenadier. From a Print Published in 1696.

Manner of holding the grenade in the British service, 1847.
(Land service grenades: 1 lb., 13 oz.)
(Naval service grenades: 4 lbs., 2 oz.)

Grenade of common green bottle glass as used by Spaniards, 1847. (External diameter 3¾ inches. Weight 10½ oz.)



A "tinker's" Mortar from Grose's Military Antiquities, 1801.
"An uncommon engine supposed to be a tinker's mortar, which being fixed in a stick was used for throwing grenades."

A Grenadier of 1745.

GRENADES AND GRENADIERS.

The electric traction line which runs from Murnau to Oberammergau, Bavaria, is some 10 miles in length. It has been equipped by the Siemens-Schuckert Company. The central station, which lies five miles from the terminus, has two turbines which are operated from the Ammer River. Alternating current dynamos are mounted on each of the turbines. The latter are of the horizontal pattern and carry a dynamo on either side, connected by elastic coupling. One of these generators gives simple alternating current for the traction line, while the other furnishes three-phase current for the local lighting. The electric road uses a tension of 5,000 volts and is one of the few electric lines in Europe which employ monophase current. One pole of the dynamo is connected to the trolley wire and the other is put to earth. Two trolleys of arc form are pressed up against the overhead wire from the car roof by a compressed-air device. The air is furnished from the brake reservoir. Each car is equipped with two 80-horse-power motors. A motor works one of the axles by a double-reduction gearing. The car contains a transformer which lowers the current to 260 volts for the motors.

KNABENSHUE'S AIRSHIP AND ITS EXPLOITS.

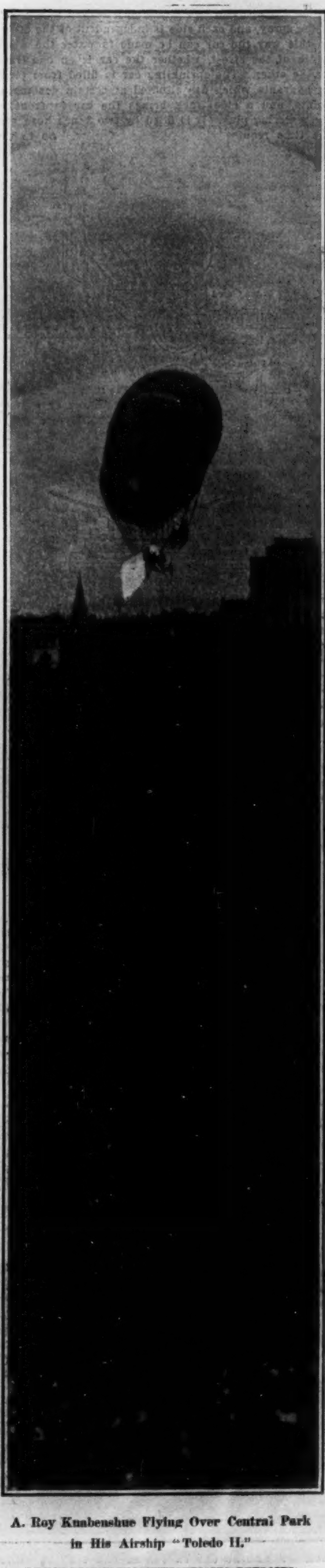
The great popularity of experiments in aerial navigation has again been proven by the interest evinced by the general public and the press of New York city in the recent successful airship flights of a young westerner, A. Roy Knabenshue. So great was the curiosity of the New Yorkers to view the flights that almost all business and street traffic was at a standstill and throngs followed the course of the great dirigible balloon hovering over the city. Mr. Knabenshue is the aeronaut who so successfully piloted Baldwin's "California Arrow" at the World's Fair, at St. Louis. The present machine, however, the "Toledo II.," is entirely his own design and construction, and is, in fact, the second that he has built for his own use and experimentation.

The gas bag, 62 feet in length, which supports the framework carrying the motive power and the motive and steering apparatus, as well as the navigator, is cigar-shaped, the forward end being sharply pointed, while the rear extremity is rounded. The highest point of the curve of the upper surface, as well as the greatest diameter of the bag, 16 feet, is about one-third of the length from the forward end. The curve of the under side is somewhat flatter. The shape of the balloon differs materially from that of the "California Arrow," which is practically a long cylinder with pointed ends. Mr. Knabenshue states—and his experience with both types makes the statement authoritative—that with the latter shape the airship is given to pitching badly because of the movement of the body of gas in the bag, but that this difficulty is obviated in the "Toledo II.," as the curved lines of the balloon permit of little or no shifting of the gas. Moreover, the wind-resistance appears to be less with this shape, especially as the diameter is a foot less than that of Baldwin's machine. The material used in the construction of the balloon is the finest Japanese silk, of great strength and exceedingly light weight, covered with a special varnish prepared by the aeronaut himself, which is said to be superior to anything of its kind hitherto used. The balloon of the "Toledo II." requires 7,000 cubic feet of hydrogen to inflate it, this being somewhat less than the quantity necessary for the "California Arrow," as the latter's cubical content is 8,000 feet. The framework is hung to the bag by means of a square-mesh net of strong cord, as the aeronaut believes this form to be superior to the usual diamond-mesh. The entire weight of the bag is but 65 pounds.

The framework is 38 feet in length and consists essentially of three parallel longitudinal pieces, forming a triangle in cross section, which come together in a point at each end. These are braced and tied in their proper relative positions by means of wooden struts and piano wire. The wood used is almost all spruce, with the exception of a few pieces of bamboo. The netting from the balloon is fastened to the two lower longitudinal frame pieces which lie in the same horizontal plane. The weight of the framework, as well as the entire apparatus upon it, is approximately 210 pounds.

The two-bladed propeller, which is at the bow of the machine and pulls rather than pushes it, is 10 feet in diameter. The blades are 29 inches wide at the outer extremity, and narrower toward the hub. The covered length of the blade is 40 inches. The framework of the propeller is of spruce, the covering fine muslin. The entire weight is 7 pounds. The following figures of the propeller thrust are the results of some rather rough experiments carried on by Mr. Knabenshue, who is at a loss to explain the wide discrepancy between the last two: At 150 revolutions per minute the thrust was 22 pounds; at 180, 35 pounds; at 200, 41 pounds; at 210, 46 pounds; and at 220, 61 pounds. The usual rate used during a flight is 180 revolutions per minute, and at this the speed is estimated to be 15 miles per hour. The rudder, at the stern, is also of spruce and muslin, and is about 9 feet long and 5 feet wide. This is hung to the framework and to a bamboo support attached to the netting. It is worked by cords running nearly the entire length of the framework, so that the aeronaut may have control of his steering apparatus regardless of the position in which he may be.

The engine which drives the propeller is located about a third of the length from the forward end. It is supported on two angle-iron cross pieces on the two bottom bars of the framework. It is a four-cylinder, air-cooled, gasoline motor, and is geared to the shaft by means of a chain and sprocket. An ordinary friction clutch is used. The cylinders are 2¼-inch bore and 3-inch stroke. The greatest rate of speed obtained by the engine was 2,160 revolutions per minute, though this is far in excess of the speed used during the flights. The reduction of the engine speed to shaft speed is 6 to 1. The horse-power is estimated at 10. The speed is regulated entirely through the sparking, no throttling of the explosive mixture being attempted. The entire weight—engine, shaft, clutch, batteries, and tank—is 92 pounds. The tank will hold sufficient gasoline for a five-hour sail.



A. Roy Knabenshue Flying Over Central Park in His Airship "Toledo II."

KNABENSHUE'S AIRSHIP AND ITS EXPLOITS.

Unlike Santos Dumont, or the French aeronauts, Mr. Knabenshue does not attempt to regulate the height of the machine above the earth by means of a gas valve attached to the balloon. As a matter of fact the "Toledo II." has no such valve. When the bag is filled with hydrogen the silk neck or gas inlet is simply tied with a piece of rubber. The elevation is determined by the quantity of gas in the balloon, as after rising to a certain height this is expanded by the decrease in atmospheric pressure, and bursts the above-mentioned neck, releasing some of its volume and allowing the machine to settle to earth. Otherwise, Mr. Knabenshue simply descends by pointing the nose of the balloon downward, and using the screw, the power of which is sufficient for this purpose. The angle of the machine, with reference to the horizontal, is attained entirely by the shifting of the position of the aeronaut, who is seated astride the upper bar of the framework, one foot on each of the lower longitudinal pieces, and moves backward or forward as the occasion requires. Only about 20 pounds of ballast are carried for emergencies.

As Mr. Knabenshue himself says, he has not solved the problem of aerial navigation, and has only demonstrated that, in the absence of heavy wind, it is possible by means of the usual screw and rudder to drive and guide a balloon. The practical airship of the future must be made to dispense with the huge gas-filled bag which offers more resistance to the air currents than the canvas of a fair-sized sailing vessel. This being so, we can but regard the "Toledo II." as an interesting experiment, an astonishing toy, and while we realize that the machine is not capable of commercial use, our appreciation of the aeronaut's courage and perseverance is general and decided.

Use of the Metal Calcium.

Now that the metal calcium is produced cheaply and in large quantities, as we find in the Bitterfeld electrolytic works, it is possible to use it in different kinds of chemical operations, where it acts as a reducing agent. M. Moisson has been able to reduce the chlorides of sodium and potassium and to separate the latter metals at a red heat. M. L. Hackspill takes up this work and uses calcium in large quantities to reduce the chlorides of rubidium and cæsium. He places a mixture of calcium in small fragments and chloride of rubidium, melted and dry, in a small iron trough. This is placed in a horizontal tube having a vertical tube at the end. A vacuum is made in the apparatus and the horizontal part is slightly heated. When we reach 400 or 500 deg. C. a metallic ring is formed beyond the trough, and when heated more, the chloride is decomposed and gives off heat. This is sufficient to volatilize all the alkaline metal. It collects in the vertical tube, which is then sealed off with the blowpipe. In this way we obtain 150 grains of pure rubidium in less than fifteen minutes. The metal is very pure and is equal to that which the Erdmann process gives. It is a more rapid method and gives a better yield. Cæsium is formed in the same way. M. Hackspill also tries to reduce chloride of lithium and obtain this metal. But as lithium is not nearly as volatile as rubidium or cæsium, he only succeeds in forming an alloy of calcium and lithium.

Increase in Price of Single Numbers.

On and after this date, September 2, the price of single copies of the Scientific American will be advanced from eight to ten cents. The lower price has been in force for many years when the Scientific American was not only smaller, but when the information was obtained at comparatively small expense. We are now maintaining correspondents in the principal centers of the world, and we have enlarged the paper, and largely increased the number of illustrations. We think that those of our readers who have been in the habit of purchasing single copies from news-stands will agree with us that the Scientific American is fully worth ten cents a copy. There will be no increase in the price of subscription, which will remain $3 per year, or $1.50 for each six months. Persons who are unable to obtain the Scientific American regularly from news-dealers should subscribe direct, thus taking advantage of the reduced rate.

Cable to Iceland.

The Great Northern Telegraph Company, of Copenhagen, has obtained a license for laying out and operating a submarine cable to Iceland. The cable is to be laid from the Shetland Islands, which are connected with Scotland, to the Faro Islands and thence to Iceland, where it is to be moored at some point on the eastern coast. The government of Iceland will lay out an overland telegraph line from that point through the island and is to take charge of this itself. The telegraph company is said to be ready immediately to commence the preparatory work, so as to enable the cable to be ready for operation by October 1, 1906. It will be remembered that the Marconi Company has recently erected a receiving station at Reykjavik, to which wireless telegrams have been sent.

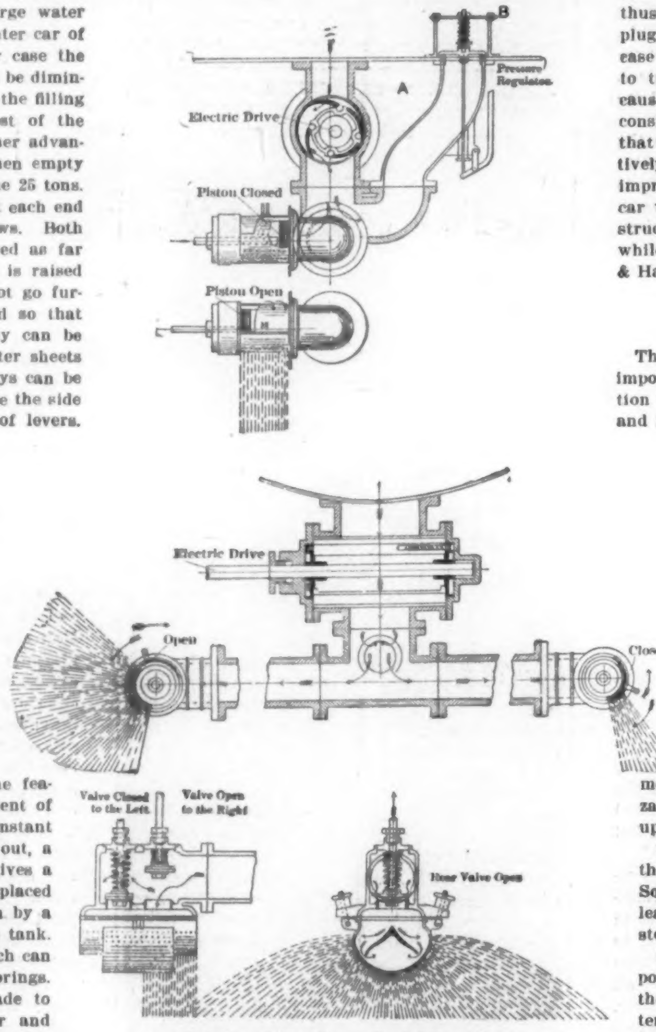
MOTOR SPRINKLER AT COLOGNE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A new type of motor sprinkling car is now in use in connection with the traction lines of the city of Cologne. It is intended to run upon the tramway tracks, and for this purpose it is equipped with a trolley pole of the loop pattern. The car is mounted upon two bogies, each of which carries a motor of the traction type giving from 35 to 40 horse-power. The reservoir has a large capacity, some 2,000 gallons, and it was considered an advantage to have a large water tank using a double bogie rather than a lighter car of smaller capacity, seeing that in the former case the number of plug stations for filling the car can be diminished, and besides, less time is consumed for the filling operation. This balances the increased cost of the larger car, and the latter has also many other advantages. The weight of the sprinkling car when empty is about 14 tons, and when filled up it is some 25 tons. There are two sprays on the sides and one at each end under the platforms, as our engraving shows. Both the sprinklers under the platforms are placed as far forward as possible, so that the dust which is raised by the car itself is laid at once and does not go further. The sprinkling apparatus is arranged so that the spread and also the width of the spray can be regulated. The maximum spread of the water sheets together is some 50 feet. Both the end sprays can be regulated by pedal from either platform, while the side jets are likewise controlled by another set of levers.

The platform sprays are shown in section in the diagram. The device consists of a sprinkling box which is connected by piping with the main water tank. In the box are two different outlets which the arrows indicate and each half is thus fed separately. A partition divides the box into two parts, and one side has larger sprinkling holes than the other, so as to change the feed. By using one side or the other, or else both together, we obtain three different strengths of water spray. An inner curved guide-plate gives an even distribution of the water. A strainer placed in the piping stops any floating matter. The two side jets are independent of the former. They are shown in the sectional views. One feature is that the width of the jet is independent of the water level in the tank and is kept constant down to the emptying point. To carry this out, a device is placed in the piping at *A*, which gives a constant feed. It consists of a rotating drum placed eccentric in a cylindrical chamber and driven by a small 4-horse-power motor situated under the tank. Upon the drum is mounted a set of vanes which can lie against the surface or can be raised by springs. During the rotation the vanes are thus made to work against the periphery of the cylinder and form a set of feeding pockets by which the water is drawn in from above and distributed to the lower pipe at a constant rate. By a pressure regulator in connection with the tank (shown at *B*) the pressure of the supply water can be controlled at will. This device is operated by levers from the platform. In this case the overflow or superfluous water is sent back to the tank by an appropriate piping. To give each of the side sprays the same pressure in the piping, the regulator can be used to control the strength of the jet. Again, the water can be let out of the sprinkler under pressure by using the motor-operated distributor, or the latter can be left open and the water flows out of the tank in the ordinary way. The former has the advantage of giving a stronger as well as a uniform jet, while in the latter case the spray varies with the water level in the tank.

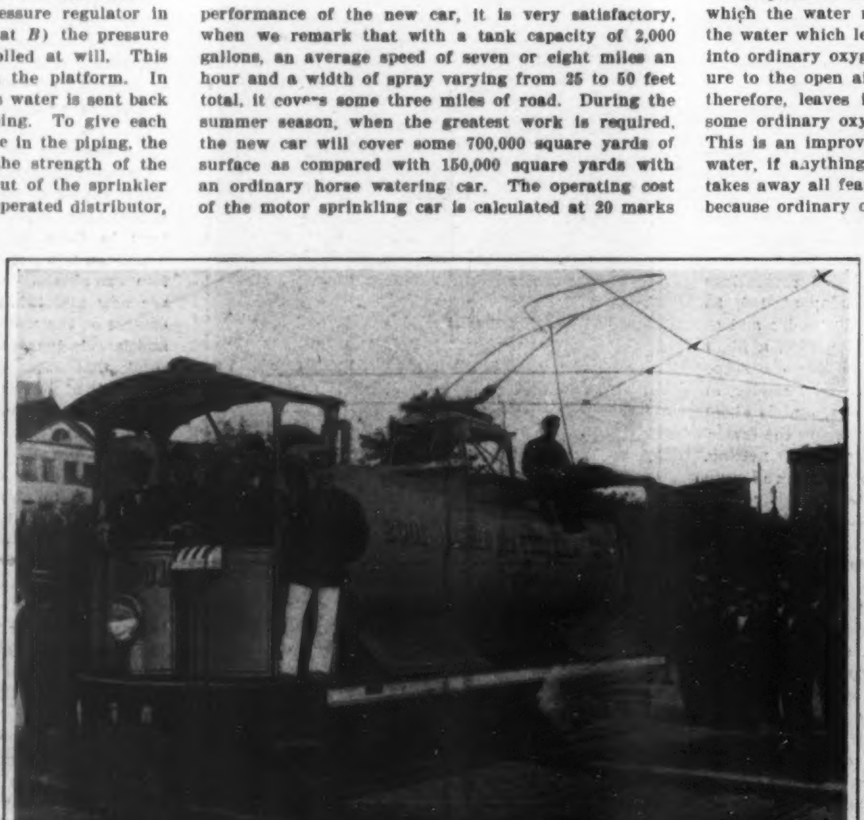
The spray apparatus has also another method regulating the pressure and also the width of the jet. This will be observed in the second diagram. The sprinkler consists of a cylinder having a number of rows of holes, and inside the cylinder is a tight piston which can be pushed back and forth so as to close off a given row of holes, and so on to a full stop of the water. This controls the width of the feed. Another device, which is shown on the right, consists of a revolving shutter which turns around the feeding cylinder and is operated by a lever. By working the shutter the holes can be uncovered more or less and so the spread of the water can be adjusted from zero up to the full feed. By using these two devices together the operator can secure any desired adjustment of the spray, and each side is independent of the other. In this way the car can be made to water the whole width of the street, whether the car is on one track or the other. The sprinkling car is filled from plugs or hydrants which are situated at certain designated points, and a side track brings the car in front of the watering plug. It is filled by two 3-inch hose, and the time required is about ten minutes. As to the



Details of the Motor Sprinkling Car.

performance of the new car, it is very satisfactory, when we remark that with a tank capacity of 2,000 gallons, an average speed of seven or eight miles an hour and a width of spray varying from 25 to 50 feet total, it covers some three miles of road. During the summer season, when the greatest work is required, the new car will cover some 700,000 square yards of surface as compared with 150,000 square yards with an ordinary horse watering car. The operating cost of the motor sprinkling car is calculated at 20 marks ($5) per day, including electric power, maintenance, and wages. For the same service, five of the horse sprinklers of 400 gallons' capacity would be needed, and the operating cost figures 10 marks ($2.50) each, or a total of $12.50. We thus have an economy of $7.50 per day for the system, and for 100 working days this gives an annual saving of $750.

In order to avoid interfering with the traffic of the electric traction lines, the sprinkling car is made to run close behind one of the passenger cars, and it is thus enabled to arrive at the next side-track at the plug station before the next car comes along. In the case of the horse sprinklers, the latter are often obliged to turn out in order to let the cars pass, and this causes a series of gaps in the sprinkling. When we consider the advantage of the motor sprinkler, and also that it covers a large extent of surface in a comparatively short time and with a smaller personnel, we are impressed with the utility of the new system. The car which is now operating at Cologne has been constructed by the firm of Zypen & Charlier, of that city, while the electrical equipment is supplied by Siemens & Halske.



MOTOR SPRINKLING CAR IN USE IN THE CITY OF COLOGNE.

STERILIZATION OF WATER.

BY EMILE GUARINI.

The subject of the sterilization of water is of prime importance because unimpeachable water is the exception in nature; it is found only in uninhabited regions, and in the soil at a level which it cannot reach without slowly percolating through thick strata of well-filtering sand. All other waters collected in populous neighborhoods, spring waters as well as surface waters, should be considered as suspicious. The conclusion is that with the exception of a very few cases, all waters should be purified bacteriologically before being distributed for potable purposes. The two practical methods of biological water purification on a large scale are: 1. Filtration, which reduces the number of bacteria water contains. 2. Treatment by ozone, which radically annihilates all pathogenic germs. Experience has shown that filtration is not always an adequate way of sterilization; moreover, it is stated that "filtration is not sterilization; it is a makeshift which should be improved upon."

Ozonization, on the contrary, is said to fulfill all the requirements of the improvement wished for. So long as ozonized water contains free ozone when leaving the sterilizing apparatus, it is practically sterile, i. e., free from pathogenic germs.

Ozone has exceptional advantages for this purpose. Without introducing any new element into the water, it destroys all discoloring organic matters, all unpleasant odors and tastes, and, with certainty, the pathogenic and other bacteria, with the exception of a few harmless spore-bearing bacilli which the water may contain. The ozone present in the water which leaves the sterilizers is retransformed into ordinary oxygen by from 15 to 20 seconds' exposure to the open air, at the very utmost. Ozonization, therefore, leaves in the sterilized water nothing but some ordinary oxygen—some atmospheric air, in fact. This is an improvement, because superaeration makes water, if anything, more palatable and digestible, and takes away all fear of injury to the distributing plant, because ordinary oxygen does not attack iron and lead mains and pipes. Several systems have been devised to sterilize water by means of ozone. The most recent among them, we believe, is the De Frise system, which embodies several new and interesting characteristics and is put in practical use at the experimental works of Saint Maur, near Paris (France).

The De Frise ozonizers are without dielectric and are kept at the proper temperature; they have sharp metallic points which receive the high-tension current, and are juxtaposed to metallic surfaces connected with the earth. They are worked with tensions higher than 20,000 volts. The air is aspired through them by pumps which force it, when ozonized, through the sterilizer. The apparatus are either horizontal or vertical. The vertical type occupies less room than the horizontal one, which is easier to survey, however. The sterilizers are made on the washer principle; they are provided with a number of

carefully leveled, finely perforated trays, making the ozonized air bubble several times through the water.

The ozonized air is used over again, the inlet of the ozonizers being connected with the outlet of the sterilizers, arrangements being provided to free the air from moisture, and to supply, by fresh air, the oxygen which has been consumed in the shape of ozone.

Count De Frise's ozonizing plant erected on the grounds of the Saint Maur pumping station of the Paris municipality has quite the size of a waterworks destined to supply with drinking water a town with several thousands of inhabitants. It treats up to 150 cubic meters of Marne River water per hour, taken either from the slow sand filters of the city of Paris or from the river, and filtered, without adding any coagulant, by mechanical filters filled with stamped silex. It shows that a plant of even much greater size can be worked by two or three men and does not want more than about 129 effective horse-power in all, pumping included, for a production of 1,000 cubic meters per hour, which is an economical result. The plant, a general view of which is shown in Fig. 1, is erected in a building of sufficient size to contain apparatus for treating 20,000 cubic meters per day. The cellars contain the motor, with its shafting, a centrifugal pump to raise the water, the alternators for the ozonizers and the electrical light, two air-dryers and the sterilizers, the tops of which reach the first floor. The first floor contains the office, the laboratory, the switchboard, the transformer, the ozonizers, and the ozonized air compressor. The motor is a semi-portable 45 I. H. P. steam engine. The centrifugal pump is able to deliver 150 cubic meters of water per hour against a head of 15 meters. The alternators are 110-volt Mordey dynamos. The transformer, shown in Fig. 2, raises the pressure of the current to a maximum of 80,000 volts. The switchboard is provided with the usual fittings. The ozonizers are horizontal. Fig. 3 shows one with resistance, and Fig. 4 with condenser. There are two series of ozonizers, each consisting of three groups of three elements. Each element is made of a horizontal brass half-cylindrical trough fitted with a plate-glass cover and a cast-iron water mantle. The trough is earthed and makes one of the poles. Across the trough, at regular distances, brass half-disks with serrated circular edges and of 60 millimeters less diameter than the trough are suspended from the glass lid by means of screws which take the high-tension current from the liquid resistances fitted to each half-disk. The resistances are vertical glass tubes sealed at the bottom, in which is soldered a platinum wire projecting on both sides of the glass. The tubes are filled with an appropriate liquid, to which the current is transmitted by a platinum wire dipping in the top of it. The resistances perform the part of regulators, preventing the tension of the portion of current allowed to each semi-circular pole, to rise above the limit at which sparks or voltaic arcs are produced. Silent discharges are produced between the sharp points of the semi-circular poles and inner surface of the earthed troughs. The troughs are closed at both ends and fitted with an air inlet at one end and an air outlet at the other. The current of air circulating between both ends passes through the succession of half annular discharges which transform part of its oxygen into ozone. After its passage through each discharge, the air, heated by electrization, is partially cooled down by the cool surface of the trough. This cooling is periodically completed by means of surface condensers intermediate between the elements of each line of ozonizers. The ozonizers are placed in a dark room; this allows of judging from the blue-violet color of the flames that the apparatus are working in good condition.

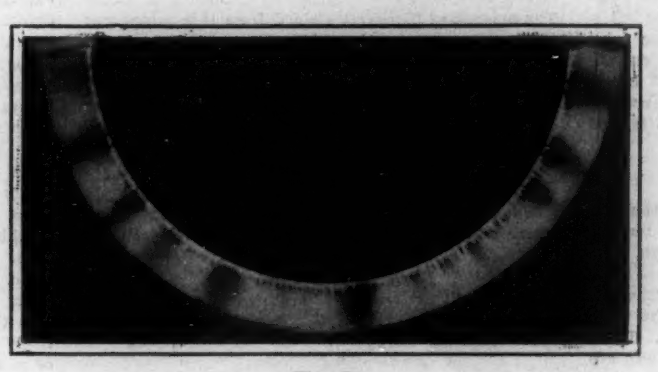


Fig. 5.

Fig. 1.—General View of the Plant, Showing Two Rapid Pressure Filters of 150 Cubic Meters Capacity per Hour.

The ozone compressors are double-acting vertical pumps of 150 millimeters diameter and 200 millimeters stroke. They draw the air through the ozonizers and force it into the sterilizers.

The sterilizers (Fig. 6) are cast-iron vertical cylinders, enameled inside. They are built up from parts, 50 centimeters high, between the flanges of which are fitted horizontal celluloid diaphragms perforated with a great number of small holes having a diameter of 0.7 millimeter.

The water and ozonized air are introduced into the lowest compartment of the sterilizers, by means of which an injector which makes use of the *vis viva* of the water arriving under pressure, to assist promoting the circulation of the ozonized air. Air and water ascend together to the top of the sterilizer, being intimately mixed at the passage of each finely-perforated diaphragm. The sterilizing columns are fitted with spyglasses and arrangements for collecting samples. The sterilized water flows from a general main into a tank placed in the open air, from which it goes into the covered reservoir for filtered water of the city. A third sterilizer at Saint Maur belongs to the type in which the water is injected in the shape of a fine spray into the mass of ozonized air. The spray collects, in the lower part of the column, as solid water, into which the ozonized air is forced through the apertures of a perforated diaphragm which makes it bubble, in minute bubbles, through the water before reaching the spray. The waste air of the three sterilizers is recuperated by simple connection of the outlet of the sterilizing columns with the inlet of the ozonizers, to be ozonized over again. Well-balanced air valves admit sufficient fresh air to make up any deficiency in oxygen of the recuperated air. The collecting tank is provided with a weir to measure the quantity of water discharged per hour. Fig. 7 gives a vertical section of one of the two rapid pressure filters (shown in Fig. 1) used in conjunction with the plant. Each of these filters consists actually of three separate filters built the one on top of the other. The three have a common central inlet pipe and each has its own bottom, its own outlet valve communicating with the discharge main shown on the right of the engraving, and its own outlet for wash water shown

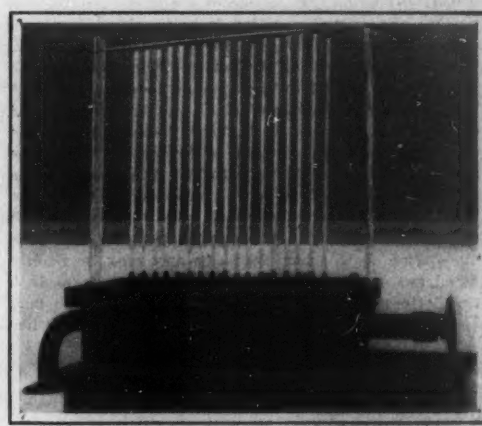


Fig. 3.—Ozonizer with Resistances.

Fig. 4.—Ozonizer with Condenser.

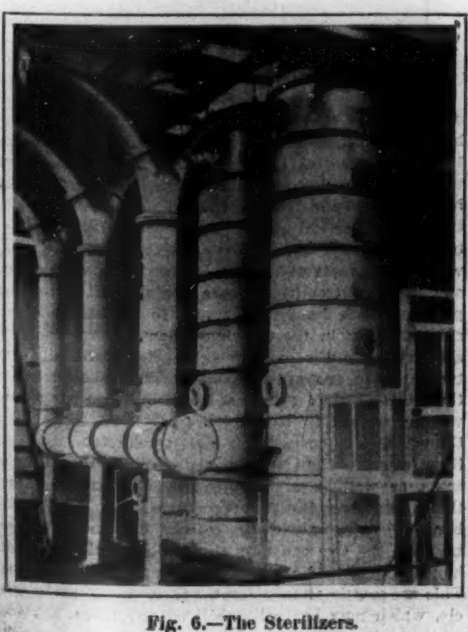


Fig. 6.—The Sterilizers.

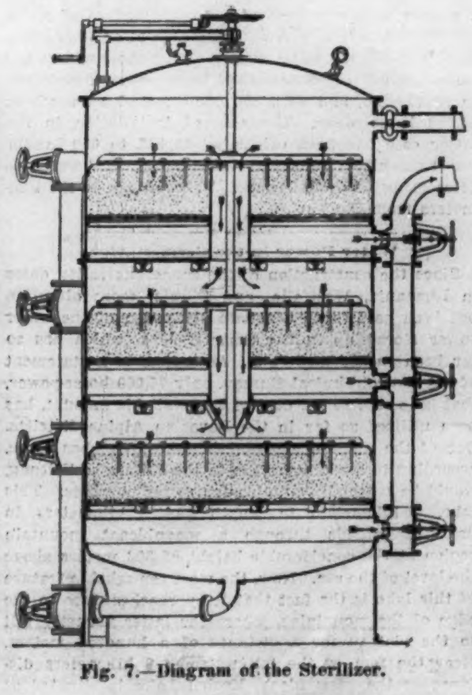


Fig. 7.—Diagram of the Sterilizer.

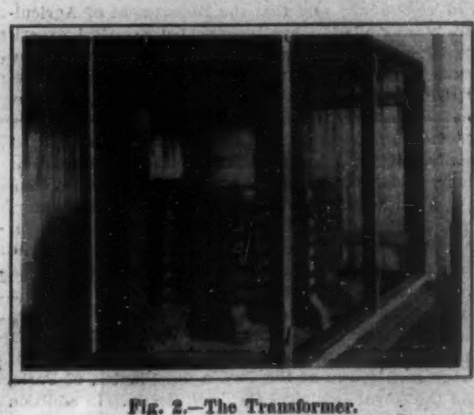


Fig. 2.—The Transformer.

STERILIZATION OF WATER.

on the left. A central shaft works the three rakes which agitate, during the cleaning, the pounded flint with which each filter is filled. Each triple filter is washed by revolving the agitators and admitting, by the outlet valves, the filtered water of its neighbor under the layer of flint through which it passes upward to be drawn off by the valve system on the left.

In a recent test the ozone consumption per cubic meter of water was 1.19 grammes, and the current consumption 122 watts, the colonies were 149 before and 2 after ozonization. In another test the above figures were respectively 2.039 grammes, 236 watts, and 2,680 before and 3 colonies after ozonization.

AN IMPROVED ASH SIFTER.

Those who are in habit of building their kitchen fires afresh each morning will be interested in the improved ash-sifting device which we illustrate herewith. The device is arranged to permit of sifting the ashes without filling the surrounding air with dust. The improved sifter comprises a box consisting of the main or body section and an upper auxiliary section. These sections are fitted together with a tight joint and are securely fastened with hasps and turn buttons. The upper section is provided with a hinged cover which, when closed, forms a dust-tight joint therewith. A hasp and turn button lock the cover in closed position. A handle on this cover provides means for carrying the device. Sockets are formed in the upper edge of the auxiliary section, at opposite sides to provide bearings for a shaft. This shaft carries a tray which is rigidly attached to it. The cover of this tray consists of a screen of semi-cylindrical form. The shaft is operated by a lever thereon which carries a crank handle at one end. Normally the shaft is prevented from turning by studs at each end of the lever, engaging lugs on the outside of the upper section. In use the pan of ashes which is to be sifted is placed in the tray and the screen cover is then fastened down, also the main cover of the device. Then the lever on the shaft is pulled outward so as to clear the lugs. The handle may now be rotated to invert the tray and pan of ashes, after which it should be rocked back and forth to sift the ashes through the screen. When the screen has been sufficiently rocked, the lower section may be disengaged to permit removal of the ashes. This body section is provided with two bails which may be swung over to the dotted position shown in the section view, when the body part may be readily lifted and carried in one hand. Legs are formed on the bottom of this section to space it from the floor and thus prevent scorching the floor or carpet when

AN IMPROVED ASH SIFTER.

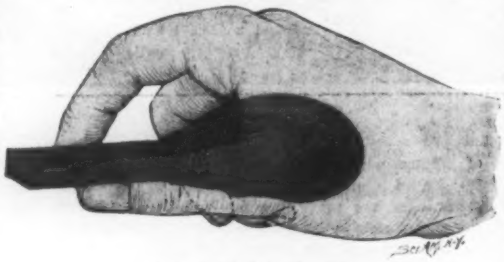
hot ashes are sifted. A patent on this ash sifter has recently been granted to Mr. Eugene A. Bagby, Bowling Green, Ky.

American Opium.

In view of the fact that the Department of Agriculture at Washington has inaugurated practical experimental study in the planting and cultivation of the opium poppy in one of the Southern States, it is timely that Dr. Emil Weschke, of San Francisco, who has most extensively worked along these lines, advances his views, deductions and conclusions in the August number of the Pacific Medical Journal. The author states that he knows of but one instance where opium, i. e., a marketable product, was grown in this country. Prof. Flint, of San Francisco, obtained good opium in the Sacramento Valley, which answered to requisite tests and possessed the physical attributes of a good article, but its production was unprofitable. It was a question of cheap labor to produce it, and this was not procurable. For his own experimental opium farming the doctor was furnished with varieties of poppy seed grown at the Jardin des Plantes, of Paris, and the Royal Botanical Gardens, Berlin. In addition to this, he procured some seeds grown in the State of New York. The seeds were planted in rich dark loam. He incised the capsules of the poppy in the usual way in the evening and the following morning gathered the concrete juice by scraping it off with a blunt knife on to porcelain plates. The product was of a rich, dark-brown color, had a bitter taste and strong odor, and, when dry, was of conchoidal fracture. The amount of morphine yielded from this opium was 15.28 per cent, narcotine 0.325 per cent, codeine 0.416 per cent, meconic acid 3.5 per cent. The author concludes that the production of opium in this country can only become profitable when the cheapest labor can be procured, and when scientific and expert supervision rules over the planting, cultivation, etc.

A PNEUMATIC ERASER.

We illustrate in the accompanying engraving an eraser which possesses some decidedly novel features.



A PNEUMATIC ERASER.

The inventor, who is a stenographer and court reporter, felt the need of some simple device for brushing or blowing away the dust of an erasure. The common habit of using the hand to sweep away the particles is objectionable when operating on manuscripts written with a copying ribbon, for unless the hand is perfectly dry it will smear the ink. Neither is the alternative of clearing away the dust by blowing one's breath on it entirely satisfactory, for moisture blots are liable to occur which sometimes destroy a whole page of matter. Furthermore, the inventor found that bending over to blow away the dust every time he made an erasure was very trying on his patience. As a solution to the difficulties it occurred to him to use a rubber syringe to blow away the dirt and a further development was to combine the eraser and the syringe, as shown in the illustration, so that the two operations could be done with one tool in the hand. An eraser of standard type is used in which a hole is bored, as indicated by dotted lines. The eraser is fitted into a rubber bulb and serves as a nozzle of the syringe. In use the eraser is held as illustrated, with the bulb in the palm of the hand. After rubbing out the desired mark, the eraser is lifted a trifle from the paper so as not to close the air duct, then on squeezing the bulb the dust and dirt of the erasure will be blown away. When one eraser is used up it may be removed and another inserted in the bulb. Mr. C. S. McGill, of Owensboro, Ky., is the inventor of this novel eraser.

Power Transmission to Stockholm.

According to a note in "Tekniek Tideskrift" an agreement has been arrived at between the managers of the Stockholm Gas Works and the Söderfors Bruks A. B. with a view to the purchase of two waterfalls of the Dalelf. These waterfalls, which are situated on the same branch of the Dalelf River, give a head of 7 meters with a volume of 250 cubic meters of water per second, which will be obtainable after regulation. With a minimum water supply of 100 cubic meters per second, about 10,000 electrical horse-power is obtained in Stockholm, and with 250 cubic meters as much as 26,000 horse-power. The cost of installation in the latter case has been calculated at 525 to 550 kronor per transmitted electrical horse-power, the purchase price being 1,150,000 kronor. The distance is 125 kilometers from Stockholm.

Water Power in the German Alps.

Since the construction of the numerous valley dams in Rhenania, Westfalia, and Silesia, more attention has been paid to an adequate utilization of the water power stored up in the German Alps, which has so far been rather neglected. According to a statement of the Hydrotechnical Bureau, only 75,000 horse-power, that is to say, 10 per cent of the available amount, has been utilized so far in the Bavarian Alpine districts. Out of the numerous mountain lakes, Walchen Lake, according to a recent article in the Kölnische Zeitung, would be especially suitable for power purposes. This lake, 6 kilometers in length and 5 kilometers in breadth, extends through a magnificent mountain region at the considerable height of 803 meters above the level of the sea. Now, the most remarkable feature of this lake is the fact that it approaches close to the edge of the mountains, where the latter abruptly fall to the plateau for a distance of a hundred meters. Near the foot of the latter (some 2 kilometers distance as the crow flies), Kochel Lake is situated at only 601 meters height above the level of the sea. Now, as this lake is likewise of considerable size, the head of 202 meters between the two lakes would no doubt have long been utilized for the production of electrical power but for the fact that Walchen Lake would be exhausted very shortly in case a juncture be effected with Kochel Lake. Now, nature seems to have afforded a possibility of supplying enormous amounts of water to Walchen Lake from the immediate neighborhoood. In fact, the Isar River, which has an extremely heavy flow of water in the spring and summer, passes at a few kilometers to the south of Walchen Lake at a still greater height above the level of the sea. Whereas, throughout the larger part of the distance a high mountain separates Walchen Lake from the Isar, two rivulets joining the river and Walchen Lake respectively pass close by one another in the neighborhood of the Munich-Mittenwald-Innsbruck road. To lead the water of the Isar into Walchen Lake, this relatively level ground could be made use of, or else a tunnel would have to be pierced. In any case the cost of a similar installation would be relatively low, the dam basin being available. The amount of power that could be derived with the head of 202 meters from the water masses of the Isar is thought to be sufficient to warrant the electrical operation of a great part of the Upper Bavarian state railways. As the neighboring district has up to now no industries worth speaking of, the electrical power would, indeed, have to be used for a similar purpose, unless it be preferred to transmit it to Munich. From the fact that the above projects are at the present moment being considered by the department of communications, we may infer that it is the intention to introduce an extensive electric railway system.

A NEW TOY.

In the accompanying engraving we illustrate a recently patented amusement device, a novel form of see-saw, the invention of Mr. Edwin D. Smith, of 248 Fourth Avenue, Pittsburg, Pa. The device was designed to provide a light, simple, and portable construction adapted more particularly for the entertainment and amusement of children, and for this purpose the inventor made use of the principle of the lazy-tongs, as shown by the illustration.

The central post, consisting of two similar and parallel pieces, is erected upon a suitable base. In this case the longitudinal member of the base is firmly bolted between the two pieces of the central post, rigidly joining it with the base, and at the same time separating the said pieces at the proper distance. The

A NEW TOY.

cross-piece of the base may be turned about a pivot bolt into a longitudinal position, to facilitate the storing or shipping of the see-saw. Three parallel bars, the upper one shorter than the other two, are pivoted by means of bolts between the two sections of the central post. Vertical shanks carrying seats are pivoted to the two lower bars at their extremities. Two other vertical bars pivoted to all three longitudinal bars, and at the extremities of the upper, shorter one, are provided with handle bars and foot-rests. The see-saw is shown in the drawings adapted for persons of approximately the same weight. The parallel longitudinal bars are provided with several bolt-holes so that it is possible to adjust the device for persons of varying weight by shifting the bars lengthwise upon the posts. The operation is easily understood from the illustration. The persons see-sawing when in the seats, as well as in mounting and dismounting, rest their feet upon the foot-rests, and grasp the handle bars. Then to operate the see-saw it is merely necessary for the two ocupants to push and pull with both hands and feet, if desired, in opposition to each other. This see-saw is simple, light, and an inexpensive article, which may be easily shifted from place to place, while at the same time affording much pleasure and amusement.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

HOSE-HOLDER.—A. G. BURTON, Denver, Col. The invention is an improvement in hose holders, especially designed for holding hose in use for sprinkling lawns and the like. Construction is simple and easily applied. By bending the points of the tripod so they extend parallel to each other and may be forced straight into the ground it is found in practice that but slight pressure is required to force the points into the ground and that the holder will not turn over, no matter how heavy the force of the water.

TRUCK.—W. H. ARMSTRONG, Vanwert, Ohio. The invention pertains to improvements in hand-trucks particularly adapted for carrying heating-radiators, the object being to provide a truck that may be readily adjusted to different sizes of radiators and having means for firmly gripping a radiator so as to prevent any movement thereof relating to the truck.

NON-REFILLABLE BOTTLE.—R. BERNSTEIN, New York, N. Y. The purpose of the invention is to provide an economic construction of bottle which after having been once filled and emptied can not be again filled and presented as an original package. Another purpose is to provide a bottle from which fluid can be conveniently and freely poured, and which will require no other stopper than that constituting a portion of the improvement.

MEANS FOR DISCHARGING FLUIDS FROM DRYING-CYLINDERS.—R. D. TACKABERRY, Lewiston, Maine. The invention refers to devices for expelling the air and water of condensation from drying-cylinders—for example, such as are disclosed in a prior patent, No. 643,198. The object of the present invention is to simplify the devices as much as possible, and also to maintain uniform and equal pressures in the various parts of the system. The inventor not only provides very simple and efficient means for removing air from cylinders at the beginning of operation, but also prevents sudden rises of pressures in the trap and erratic action incident thereto.

TROUSERS STRETCHER AND CREASER.—H. C. WARFEL, Philipsburg, Pa. The device in this improvement is adapted for use both for stretching and creasing trousers, is readily collapsible, so it can be folded in a small space, can be readily adjusted at one end to a desired width and be locked in such adjustment and be then spread at its opposite end to stretch the trousers, and can be fastened in stretched position.

CARTRIDGE - PACKET.—J. H. BLAKE, Batavia, N. Y. The object of the invention is to provide a packet for use in magazine bolt-guns, and is especially designed for use with the gun for which a patent was formerly granted to Mr. Blake, and a further object is to provide an efficient packet for such purposes and one which will be durable, economic, and simple in construction, and which may be readily removed from the cartridge-chamber in which it is adapted to be placed.

HYDRANT AND HOSE COUPLING.—W. R. THURSTON, Jacksonville, Fla. In this case the invention relates to improvements in couplings for connecting a fire-hose or the like to a hydrant, the object being to provide a simple and novel mechanism whereby a hose may be quickly connected to a hydrant and practically in instantaneous use, the parts being so constructed that the hose may be turned in any desired direction with relation to the hydrant.

FLUSH-VALVE.—J. P. GOODFELLOW and S. R. RAMSAY, New Westminster, Canada. The objects of this invention which relate to a flush-valve are to improve the construction of devices of this character in such a manner as to do away with the annoyances of the ball-cocks, floats and the like now in use, to simplify the construction of such devices, and especially to provide a valve which will be balanced under all pressures.

FOLDING TABLE.—M. LANDSMAN, New York, N. Y. This improvement has reference to tables, and more particularly to those which may be folded to occupy a comparatively small space. Its principal objects are to provide a device of this class which may be conveniently operated, and which will furnish a table support when in an opened or assembled position. The table is preferably made up of wooden members and is light and strong.

PREPARATION FOR CLARIFYING CANE JUICES.—G. B. WILLIAMSON, Gramercy, La. The invention relates to a preparation for clarifying cane juices and syrups and to a method of using the preparation. The inventor treats the raw juices with paste, then evaporates them to syrups, next treats them with a liquid made from the paste, and finally reduces them to sugar. The paste is likewise used in syrups before filtration through ordinary bone-black, the impurities being removed by mechanical filtration. Neither sugar nor syrup is injured, and percentage of output is greatly increased.

SHOE LACING.—ELIZABETH FALCONER, Louisville, Ky. The object in this method or system of lacing shoes, is to obviate the annoyance of the tangling loops and ends and also to dispense with the necessity of daily lacing and unlacing the shoe, thereby providing a system of lacing which requires no attention except when a new lace is needed to replace a lace worn and useless. The invention is adapted and suitable for all kinds of laced shoes.

Heating and Lighting.

APPARATUS FOR MIXING AIR AND GAS FOR ILLUMINATING PURPOSES.—H. L. KARGER, 26 Frankfurter Allee, Berlin, Germany. In accordance with this invention uninterrupted operation is provided for by means of circulation-conduits in appliances for mixing gas and air; and also for the supply of the mixture at a high pressure, so that in this case both air and gas or two different kinds of gas are sucked in and forced out. Suction of two kinds of gases may be effected either into a common chamber or separate chambers. Employment of special circulation-pipe for gas and another for air is not possible, because exact co-operation of the valves leading back to the pressure-main is unattainable.

Household Utilities.

SHADE ATTACHMENT.—J. K. PUTNAM, Montpelier, Ind. This improvement pertains to shades such as used upon the inner side of windows in order to exclude the light. It concerns itself especially with the construction of the shade attachments, the purpose being to facilitate the mounting of the shade and to provide improved means for controlling the position of the same.

Machines and Mechanical Devices.

GEARING.—H. H. GOODSELL, Leechburg, Pa. Mr. Goodsell's invention relates to heat-controlled gearing, and admits of general use, but is of peculiar importance in connection with furnaces and the like for the purpose of compensating the effects of expansion and contraction, which otherwise tend to disturb the relative positions and proper working relations of the various movable parts. It is preferably employed in connection with furnaces of the general type described in this inventor's application formerly filed, but the present invention is not limited to use upon furnaces of that kind.

APPARATUS FOR COALING VESSELS.—L. A. DE MAYO, New York, N. Y. The prime object of this invention is not only to elevate the coal to and distribute it into the coaling-port of the ship, but to provide means for distributing the coal into the bunker-hatches, thus reducing to a minimum the work of hand-trimming. Mr. De Mayo attains this end by providing, in combination with the elevator proper, a peculiarly arranged distributer, which takes coal from the elevator proper and conducts it to any point within the interior of the ship, this means being extensible and adjustable and being of such structure that it may be taken apart and removed from the ship through the coaling-port.

LINOTYPE - MOUTHPIECE.—R. COLLINS, San Francisco, Cal. In the present patent the object of the inventor is the provision of a mouth piece for the metal pot or crucible of a linotype machine, by means of which mouthpiece to allow a better flow of metal into the mold and also to allow for the thorough venting of the mouth piece, thus preventing defective slugs.

REVERSIBLE TRANSMISSION-GEARING.—C. W. CASE, JR., and T. E. CASE, New Orleans, La. This invention refers to a means for transmitting rotary movement in either direction, and in its preferred embodiment the apparatus comprises clutch-faces acting directly to connect the two shafts or other parts and friction-gears and an intermediate pinion serving to connect the two parts to turn them in the opposite direction, the clutch and gears having a peculiar arrangement whereby upon shifting the device the clutch and gears go alternately in and out of action.

Railways and Their Accessories.

CAR-UNLOADER.—W. P. WHITNEY, Veedersburg, Ind. The aim in this instance is to provide a construction whereby any material that will slide—such as coal, shale, grain, etc.—may be readily unloaded from a car. The conveyer or conveyers may be extended over the ends of the car in order to dump material higher or lower or to side or sides or at any suitable distance from the car and under certain construction may be operated to unload from both ends of the car at the same time.

CAR-DOOR LOCK.—T. CODE, Chickasha, Indian Ter. The invention pertains particularly to improvements in locking devices for grain-car doors, the object being to provide a locking or securing device that may be readily operated and that when in locking position will hold the door closely against the inner side of the door-frame, thus preventing the leaking out of grain.

MAIL-CRANE.—W. E. WESTERMANN, Oldfort, N. C. This inventor's improvement is in that class of devices or apparatus arranged alongside a railroad track for holding a mail-pouch or mail-bag suspended in such position that it may be seized by a person or a passing train or removed by a device forming an attachment of a mail car.

CAR-BRAKE.—C. J. SPECHT and C. R. KRUEGER, New York, N. Y. This invention is mainly intended as an improvement over a brake previously patented by the same inventors. The subject of the present improvement relates largely to the means for supporting the shoe, separate sustaining means being arranged to coact respectively with the upper and lower portions of the brake shoe, whereby to better insure the desired movements of the shoe for its effective action.

Pertaining to Recreation.

MERRY-GO-ROUND.—B. KIPPELS, Moorhead, Minn. This invention is an improvement in what are variously termed "merry-go-rounds," "carousels," and "roundabouts." It is more particularly an improvement upon the machine or apparatus for which Mr. Kippels obtained a former Letters Patent. The inventor forms a merry-go-round which is distinguished by maximum strength, lightness, and ease of propulsion. It may be produced at small cost and easily set up or removed.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
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Inquiry No. 7211.—For manufacturers of large gasoline burners.

Inquiry No. 7212.—For manufacturers of mimeographs.

Inquiry No. 7213.—For manufacturers of colored glassware; also address of a dental supply house.

Inquiry No. 7214.—For manufacturers of yacht and launch supplies and fittings.

Inquiry No. 7215.—For manufacturers of looms for weaving woolen blankets.

Inquiry No. 7216.—For address of Stevens Dishwashing Machine Co.

Inquiry No. 7217.—For a small hand vacuum pump for experimental purposes.

Inquiry No. 7218.—For the address of the importers of wire called "meteor" wire, used for the ignition points on igniters for explosive engines.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9743) P. E. F. says: On rear of St. Patrick's Church, Elizabeth, N. J., is a large copper cross. When it was put up about ten years ago it was turned northwest and southeast; now it is turned about 80 deg. to the right. It turned by degrees and is still turning. Can you or any of your readers explain how or why it turned? A. We can only suggest what seems to be a possible cause for the turning of the cross on the top of the church, that it may be due to some slight inequality in the length of the arms of the cross, so that the wind is able at times of storms to turn it by its unequal pressure on the two arms.

(9744) R. E. S. says: In your valuable paper, the SCIENTIFIC AMERICAN, of July 29, 1905, under the heading, "Five Thousand Degrees of Heat," I find these words: "We have a heat that cannot be surpassed, and we obtain, in fact, a heat of 5,000 deg." Now, are you aware of the fact that the Carborundum Company, of Niagara Falls, uses 7,000 degrees of heat in producing its so-called carborundum? A thousand horse-power of electric energy, furnished by Niagara, is said to be converted into over 7,000 degrees of heat. In fact the heat is said to be so intense that it burns and vaporizes every known element. I have heard, from various sources that Thomas Edison, in trying to produce diamonds, led to the discovery and manufacture of carborundum. Carborundum is a mixture of sawdust, sand, and salt fused with coke at the tremendous heat of 7,000 deg. It is said to be diamond in character, of the same hardness, and even more indestructable. It is made up into wheels for grinding purposes and also made into hones and the like, and is, I assure you, absolutely the best grinding substance known. The above facts I take from a paper furnished by the Carborundum Company to one of its agents. A. We note your criticism of the phrase used by our Paris correspondent, "A heat of 5,000 deg." It is doubtless true that the electric arc furnishes the highest known temperature, and that this is the temperature at which carbon volatilises. It is not so easy as you seem to assume it to be to determine just what that temperature is. The latest book on the electric furnace, by J. Wright, published 1905, contains this statement, page 9: "The temperature of the electric arc itself has never been determined." The highest authority in the world upon the electric furnace is without doubt Henri Moissan, of Paris. In his book, "The Electric Furnace," published July, 1904, page 10, he says, "We do not know the temperature of these pieces of apparatus; it depends upon the temperature reached by the electric arc which may be, according to Violle, 3,500 deg." This corresponds to 6,300 deg. F., since Violle used the Centigrade scale. The temperature of the electric arc is probably limited by the temperature at which carbon is volatilized. This has been variously estimated at from a little above 5,000 deg. F. to about 7,000 deg. F. In Chatelier's "High Temperature Measurements," published September, 1904, page 302, the "extreme temperature of the electric arc" is given at 3,600 deg. C., which is 6,500 deg. F. Wootham, in his book, published 1904, "Recent Development of Physical Science," page 77, gives the temperature of the electric arc as 3,000 to 4,000 deg. C., or 5,400 to 7,200 deg. F. We have given you the results as stated by the most reliable authorities. And we can say that we are not aware that it is certain that a temperature of 7,000 deg. exists in the electric furnace. It appears that our Paris correspondent used the lowest estimate of the temperature, while the advertising circular which you quote and which we have at hand uses the highest estimated temperature of the apparatus, as is natural that it should do. We do not know why our correspondent used the lowest figures, and personally we are accustomed to give both extremes when we use any figures on this point. One way or the other there is nothing to dispute about. If you will read the books we have quoted, especially the "High Temperature Measurements," which we can furnish for $3, you will appreciate the work done in this direction and the difficulties of the problem. Moissan's "Electric Furnace" is also a book well worth reading by any one who would know the facts in the matter. We send it for $3. This book contains the full history of the effort to produce diamonds arti-

ficially, in which Moissan has been the chief experimenter and the most successful one. It may be that Mr. Edison has taken a hand in this line of work, since he has done so in almost every line, but his name has not been publicly associated with the artificial production of diamonds. Your sources of information in the matter may be better than ours. The invention of carborundum is credited to Mr. E. G. Acheson in 1893. Moissan, "Electric Furnace," page 264, says: "I had occasion to find, in 1891, . . . small crystals of a silicide of carbon . . . I did not, however, publish anything on this subject at the time, and the discovery of the crystallized carbon silicide really belongs to Acheson." It is not "diamond in character," as you state, since the diamond is simply crystallized carbon, while carborundum is a compound of silicon and carbon. It is next to the diamond in hardness, or between 9 and 10 on the mineral scale of hardness. Being harder than emery it is a better abrasive, although emery is still preferred by some.

(9745) M. H. asks: 1. What is a range-finder, such as are used on warships? A. A range finder is an instrument for determining the distance and direction of any object. We can send you eleven SUPPLEMENTS containing valuable articles describing various kinds of range finders, at ten cents each. 2. Is it identical with a distance indicator? A. There are many forms of this instrument, some of which may be called distance indicators. 3. About how long, or how much time is usually consumed in finding the range with such an instrument? Has any instrument yet been invented or devised which will show or tell the distance of an object in from five to fifteen seconds of time? A. We do not know how quickly an experienced person could plot the result after the observations are taken. 4. Can a wind gage be made by an amateur mechanic which will record somewhat accurately the velocity of the wind? A. The velocity of the wind is usually measured by revolving cups placed upon arms. The revolving parts actuate gears which communicate motion to hands upon a dial. A skillful amateur could copy such an instrument if he had one at his disposal.

(9746) A. G. says: I think your explanation of the cause of a ball's curving in Question 9680, erroneous. You say: "The rotation of a ball is such that the air pressure is greater on the side toward which the ball rotates, pushing the ball in the opposite direction. Now, while without doubt the ball curves in the opposite direction from its rotation, I don't think you have stated the true cause of its curving. It seems to me that the greater air pressure is not due to the rotation of the ball but to its flight, hence it is always on the same side, namely the front, hence the ball must act upon it, not it upon the ball, to produce a variety of curves. In a word, the rotation of a moving ball gives it the tendency to circumvent, as it were, the resistance of the air, and so force itself more and more from its path. The only rotation that has no curving effect upon a ball's flight is that which has its plane parallel to the plane of the resistance such as is given the rifle projectile. A. We regret that you should not be able to agree with our statement of the curving of a ball, since it is not ours simply, but the conclusion of the highest authorities in mathematical physics. We would refer you to Hastings and Beach, "General Physics," page 135, where you will find the discussion of the subject.

(9747) M. W. S. asks: Is there any difference between a foot square and a square foot? Also, is there any difference between an inch square and a square inch? The last one was answered in a certain paper as follows: "Yes, twelve times the difference." Professors here claim there is no difference. A. There is no difference in area of surface between a square inch and an inch square, between a square foot and a foot square. There is a difference in meaning, however, between the two expressions, which we will illustrate. A piece of paper is an inch square when its corners are all right angles and its sides are all one inch in length. Similarly a board is one foot square when its sides are all equal and exactly one foot long and its corners are all square or right angles. A foot square implies a square whose surface is one foot. On the other hand a board may be of any shape whatever and be a square foot, if its area is one square foot or 144 square inches. A strip one inch wide and 12 feet long would be such a board. It might be irregular in shape and contain a square foot of surface. It would then be a square foot. The answer you quote from a paper is not correct.

(9748) A. W. P. writes: 1. What is a noise? Is it simply the vibrations caused by a moving object, or is it the action of the vibrations on the ear drum? For instance, suppose that a tree in the woods fell with no one near to hear it. Would there be a noise? Psychology teachers claim there would not. A. The word "noise" is used in two senses; in one sense it is the sensation which the mind perceives, in the other it is the physical cause of that sensation. If there were no person present the fall of a tree would not produce any sensation in any one's mind. It would, however, produce the same shock upon the air as if some one were present to hear it. The psychologist would say there was no sound, the physicist would say there was a sound. It is simply a difference in definition of a word. Both are right. The dictionary would give you this statement of the case. Text books of science and psychology usually contain it. 2. What is the complementary color of purple or violet? Is it green or yellow? A. The complementary color of purple is green. 3. Concerning wireless telegraphy, I have read that "the receiving antennæ should be about one-fourth the length of a wave." How may the length of the wave be determined? A. The length of electrical waves is dependent upon the number of oscillations per second of the discharge. With 300,000,000 oscillations the waves are about 3 feet long, since the speed of the waves is about the same as that of light. The mode of securing waves of a particular length is discussed in the several systems in Mayer's "Wireless Telegraphy," price $2. 4. Which is the best battery to use with a small induction coil (spark) for experimental purposes—one that will give a steady current and not annoy one by polarizing every few minutes? A. For experimental purposes you will find the plunging bichromate battery as satisfactory as any. A good form is described in our SUPPLEMENT No. 792, price 10 cents.

(9749) G. R. M. asks: Will you kindly answer the following through the columns of notes and queries in your valuable paper, and oblige a faithful reader: 1. What causes the changes of the moon? A. The phases of the moon are produced by the moon's revolution around the earth. The sun shines upon the moon all the time. When the moon in its motion around the earth comes between the sun and the earth, the sun is shining upon the side of the moon which is farthest from the earth. The dark half of the moon is toward the earth. That is the time of new moon. About two weeks later the moon has traveled around so that it is farther from the sun than the earth is, and the earth is between the moon and the sun. The lighted side of the moon is toward the earth. That is full moon. As the moon has changed from showing no lighted surface to the earth to showing the entire lighted surface to the earth, there was a time when she showed half her lighted surface to the earth. That was first quarter. Similarly there will be a time between full and new moon, when she will show half her lighted surface to the earth. That is last, or third quarter. If you will look up this matter in astronomies in your city library, you can read about it, and see the illustrations of it in the books, which will give you a much better idea than mere description in words. Ask the librarian about it. 2. Why does the mercury in the barometer stay higher when storms come from an easterly direction than it does when they come from any other direction? I have noticed this time and again and some of our largest and worst storms come from the east, and still the mercury will stay away up. I have wondered if the ocean had anything to do with it. As regards the power of a telescope, what is meant when manufacturers say they magnify 20, 33, or 50 diameters. A. We were not aware that a storm coming with an easterly wind was characterized by a higher barometer than one which comes with the wind from a southerly quarter. Storms always travel from west to east around the world. In crossing our country the paths curve considerably because of the mountain ranges, plains, and rivers. In the storm the wind blows inward toward the center, and the storm as a whole rotates from east to north, west and south, as we say, opposite to the hands of a clock in the northern hemisphere. This causes the northeast winds in the northern front quarter of such a storm. The ocean has little influence on these storms as far west as Ohio. The storm does not come from an easterly direction, but from the west, and the wind in its whirling in the storm blows from an easterly quarter in the front, and from a westerly quarter in the rear of the storm as it goes away. It clears off with a westerly wind, as you have observed.

(9750) E. C. asks: If the following problem can be solved, please give the solution in your inquiry column of the SCIENTIFIC AMERICAN. You will note that no rate of speed or length of time is given. A column of soldiers twenty-five miles long are on the march. A courier is dispatched from the rear to deliver a message at the head of the column. He delivers the message and returns to the rear, when he notices that the rear of the column is at the same point at which the head of the column was when he started. How far did he ride? A. The problem is possible of solution without having the rate of speed of either the soldiers or couriers given and without having the time known. The solution is as follows: Let Y = the number of miles traveled per hour by the courier. Let X = the number of miles traveled per hour by the soldiers. Then $\frac{25}{Y-X}$ = the time required to reach the front, and $\frac{25}{Y+X}$ = the time required for the courier to reach the rear of the column again. The sum of the two above quantities equals the time required for the soldiers to march 25 miles; therefore,

$$\frac{25}{Y-X} + \frac{25}{Y+X} = \frac{25}{X}$$

Solving this equation we find that X equals 0.41 Y or Y equals 2.41.

The soldiers traveled 25 miles. The courier went 2.41 times as fast and traveled for the same length of time, therefore he traveled 2.41 × 25 miles or about 60.25 miles. This solution is based on the assumption that both the soldiers and the couriers are traveling at a uniform rate.

(9751) A. W. asks: 1. What is meant by "polyphase" as applied to electric engines; and by "cycle" as applied to gas engines? A. A cycle is a series of changes through which a varying quantity passes, including all its values, and it fluctuates through these changes periodically. Thus a cycle of an alternating current of electricity is the successive values of the E. M. F. through one series of changes from zero to its highest value, and down through zero to the lowest and back again to zero. This succession of values the current will have as many times per second as there are cycles, ordinarily 30, 60, or 120. Polyphase currents are those whose E. M. F.'s differ from each other by a fraction of a phase. Thus three currents a third of a cycle apart will furnish a three-phase current in the lines with which it is connected. See Sloane's "Electrician's Handy Book," price $3.50. A cycle is like a complete succession of the heights of one tide in about twelve hours at the seashore. A phase is any single value or height of the water. If two or three tides come together by different channels in the same place or bay we have a two-phase or three-phase current of the tide. 2. What is meant by jibing a sail-boat? A. A sailing vessel is tacked when in changing from one course on the wind to another it presents its bow to the wind; it is jibed when it is turned in the opposite direction so that it presents its stern to the wind. In a high wind the latter is always a difficult and sometimes a dangerous operation. 3. Is a catboat so called because the mast stands straight up at one end of the boat like a cat's tail from its body? A. We are certain that a catboat is not so called because its mast stands straight up like a cat's tail. The mast is at the front end of the boat, and so far as we have observed cats have their tails set at the stern end. We do not know the derivation of the name catboat, but think it far more likely that it was given because of the quickness with which these boats will come about. 4. Does an electric motor differ in structure from a dynamo? Can they be interchanged? A. There is no theoretical difference between a dynamo and a motor. In general, each may be used for either service. There are, however, many structural differences between the two classes of machines, so that it can be easily told to which class any particular machine belongs. 5. How can a steady, effective current proceed from a dynamo giving an alternating current? The current changes polarity each instant, as understood. A. A steady current is not produced by an alternator. An alternating current can, however, be changed to a steady direct current by means of a rotary converter. 6. What light form of motor would you recommend for driving a dirigible balloon? A. Probably some form of gasoline motor is best adapted for use in a dirigible balloon.

(9752) O. E. G. asks: 1. Is the speed of radiant heat (whose medium is the same as light) the same as light and electricity? A. The latest science does not make any such distinction as between radiant heat, light, electricity, etc. They are all the same radiation. If the waves are of a length to affect the proper nerves we feel them as heat; if they can affect the eye we see light. 2. Is the difference between light, electricity, and radiant heat due to the difference in wave-length? A. The sole difference between the several effects is due to wave-length. See the "New Knowledge," by Prof. Duncan, price $2. 3. If light moves in transversal waves, how can it move forward? A. In all vibratory motions it is the wave form simply which travels. A wind moving over a field of grain is the very best illustration of this one can have remote from the ocean. Water waves on the ocean are good illustrations of a transverse wave with an onward motion of the wave form. It is not light which moves, but a wave form. The matter which vibrates moves to and fro, the wave advances. 4. Please explain wave-length. A. Wave-length is the distance from a particle moving in a certain direction to the next particle in exactly the same condition of motion. In a water wave, the wave-length is from a drop on the crest, for example, to the next drop exactly on the crest, also. 5. What is the wave-length of electricity, and does it vary with the amperage? A. There are all sorts of wave-lengths of electricity down to very short waves, but not so short as those which produce light. Those used in wireless telegraphy with a single wire as an aerial are very closely four times as long as the height of aerial wire from which they are radiated into space. When a capacity is in the circuit this affects the wave-length. The wave-length varies with the rapidity of the oscillations of the discharge. 6. Does a heated conductor of electricity retard the current? A. A hot metal has more resistance than it has at a lower temperature, and so reduces the current which flows through it. Carbon, however, has a much greater electrical resistance when cold than when hot.

(9753) F. W. M. says: I have a house to wire for burglar alarms, closed-circuit system. Kindly tell me where I can get a cheap book or instruction paper on the subject, as to how to connect up the battery (bluestone) and run the wires from windows to battery and then to annunciator. A. We recommend and can supply you with Horstmann and Tousley's "Modern Wiring Diagrams," price $1.50, which gives a good variety of modes of wiring for burglar alarms, showing all connections.

NEW BOOKS, ETC.

SUCTION GAS. By Oswald H. Haenssgen. Cincinnati: Gas Engine Publishing Company, 1905. 16mo.; pp. 88. Price, $1.

The economy of the gas producer for furnishing fuel for a gas engine has led to its rapid introduction and adoption in this country for many large installations. That a gas producer of the suction type can be made to supply fuel gas almost as economically for a small-sized engine of 3 or 4 horse-power as for a much larger plant, will perhaps be surprising to our readers. Such a producer, however, is described in this little volume, which also gives considerable useful information, together with numerous valuable figures upon suction gas.

WHEEL GEARING. With Tables of Pitch-Line Diameters of Wheels, Proportions and Strengths of Teeth, etc. By Alfred Wildgoose and Andrew J. Orr. New York: Spon & Chamberlain, 1904. Pocket size; pp. 175. Price, $1.

This small handbook should save engineers, draftsmen, and others engaged in making calculations relating to gear wheels, much valuable time. It contains a large number of tables giving the pitch-line diameters, etc., of gears of different sizes. The pitch-line diameters are given with a degree of accuracy sufficient for all ordinary purposes, the diameters being expressed in inches and decimals and fractions of an inch. The proportions of wheel teeth given are those generally adopted by engineers, and the various dimensions for each pitch will be found tabulated in a convenient form.

REPORT OF PROGRESS OF STREAM MEASURE FOR THE CALENDAR YEAR 1903. By John C. Hoyt. Washington: Government Printing Office, 1904.

This book, which forms Paper No. 100 on Water Supply and Irrigation, is issued under the auspices of the United States Geological Survey. It forms Part IV. of the series and has to do with interior basin, Pacific, and Hudson Bay drainage. Besides the regular measurement of the flow of streams made during the year 1903, and reported herein, a considerable amount of other special information that will be of use in general hydrographic studies has been included. Reconnaissances of many of the important rivers in different parts of the country have been made, and these have resulted in a collection of much valuable data with regard to flood, water-powers, river profiles, etc. The number of regular stations for stream measurements is steadily increasing, and at present systematic measurements are taken at over 500 stations, distributed so as to best cover the needs of the various States and Territories. The expansion of the work is the result of the greatly increasing demand from the general and engineering public for stream data collected by the Survey.

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WIRELESS TELEGRAPHY.—ITS PROgress and Present Condition are well discussed in SCIENTIFIC AMERICAN SUPPLEMENTS 1425, 1426, 1427, 1386, 1388, 1389, 1383, 1381, 1327, 1328, 1329, 1431. Price 10 cents each, by mail. Munn & Co., 361 Broadway, New York City and all newsdealers.

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Nail clipper, G. Havell	797,576
Nozzle, Titsworth & Sherman	797,927
Nut, axle lock, E. T. Foster	797,726
Nut lock, J. F. Fish	797,673
Nut lock, E. M. Marx	797,777
Obstetrical pad, E. H. Pearson	797,707
Oil burner, residue crude, J. M. O'Neall	797,975
Oil cup, H. B. Sherman	797,922
Open hearth furnace, F. Baldt, Sr.	797,883
Ore roasting furnace, C. E. Keating	797,584
Ore roasting furnace, W. T. Rushton	797,915
Organ tremolo, T. V. Challinor	797,719
Oven, draw plate, G. S. Baker	798,004
Package covering machine, H. Inman	797,773
Packing, piston, P. H. Weaver	797,763
Pail cover, C. F. Dibble	797,887
Paint composition, W. A. Hall	797,683
Panels, manufacture of molded or embossed, T. J. Palmer	797,866
Paper making machine driving mechanism, H. S. Ferguson	798,029
Paper stock to pulp, reducing, F. P. Miller	797,970
Peeler, tomato, G. G. Glenn	797,680
Pendulum beat adjuster, A. M. Lane	798,042
Pen wiper and ink well, combination, L. S. Hoyt	797,892
Penholder, P. L. Keller	797,736
Phonograph, H. S. Mills	797,813
Phonograph disk record cabinet, Farrell & Nichols	798,028
Picker check, W. H. Ayer	798,003
Piling, metal sheet, J. R. Williams	797,786
Pill tile, W. E. Trahern	797,644
Pipe wrench, W. H. Brock	797,836
Pipes, split sleeve for gas, water, or other, H. Rochat	797,914
Piston connecting rod, trunk, R. Willetts	797,880
Planing machines, means for operating, M. Kellow	797,964
Planter, check row corn, Gatewood & McCarty	797,569
Planter, corn, T. M. Hendrickson	797,957
Playing ball, R. G. Wingfield	797,654
Plow, M. Z. Thomas	797,926
Plow attachment, Pate & Ellison	797,603
Plow or cultivator blade, corn, C. Grabe	797,729
Plow, shovel, H. A. Janes	797,688
Post. See Corner post.	
Print washing and drying machine, C. F. Pease	797,910
Printing presses, mechanism for driving reciprocating bed, H. M. Barber	797,789
Printing wrapping paper, apparatus for, H. B. Palmer	797,976
Pug mill, H. N. Tennille	797,636

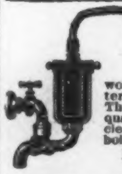
Water softening and purifying apparatus, Sutro & Booth....797,759, 797,760
Weather strip, G. N. Guthrie.... 797,954
Weighing and bagging machine, automatic, R. D. Webb.... 797,764
Weighing and package filling apparatus, automatic, W. E. Nickerson.... 797,597
Wheel, D. C. McCan....797,778, 797,779
Wheel rim, H. Pataud.... 797,781
Whip socket, H. F. Walbaum.... 797,994
Wind instrument, H. J. Ellis.... 798,025
Window, metallic, S. B. Barr.... 797,835
Window screen, Wilson & Chalstrom.... 797,652
Window screen, Hawks & Graham.... 797,851
Window tightener, G. H. Dyer.... 797,767
Wood, bending, J. A. Wilkinson.... 797,765
Wrapping machine, A. Forbes.... 797,801
Wrench, E. F. Atkinson.... 797,546
Wrench, H. J. Conrath.... 797,560
Wrench, G. McKercher.... 797,595
Wrench, F. G. Cornell.... 797,662
X-ray apparatus, portable, E. W. Caldwell. 797,718

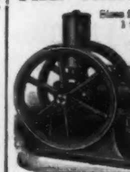
DESIGNS.

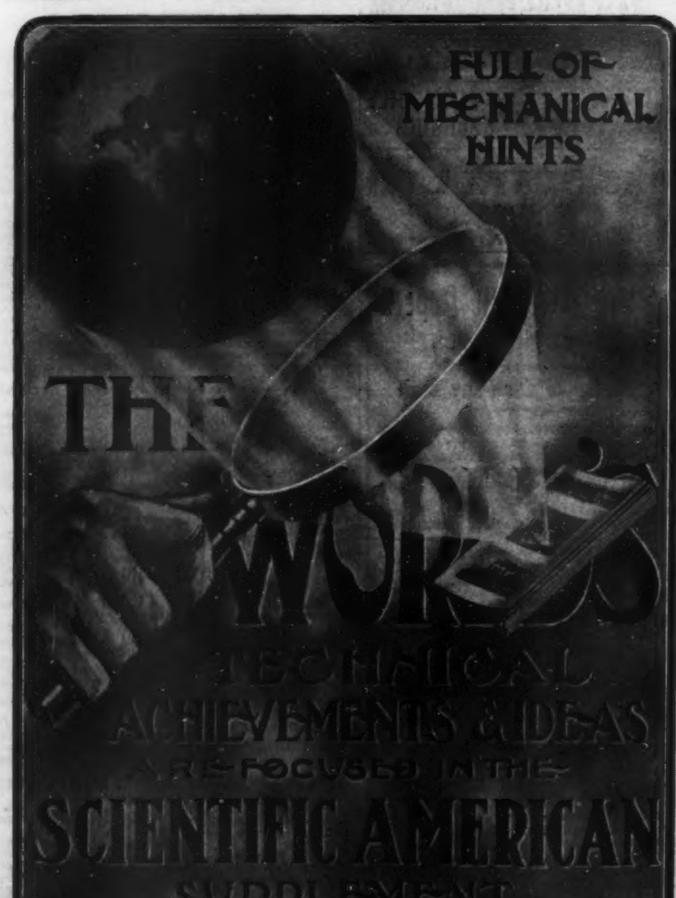
Lamp shade, A. H. Heisey....37,512, 37,513

TRADE MARKS.

Antiseptics, Columbus Pharmacal Co.... 45,447
Asphaltum, Globe Asphalt Co.... 45,647
Baking and yeast powders, M. C. Young.... 45,522
Baking powder, Siegel, Cooper & Co.... 45,523
Baking powder and cooking soda, Southern Soda Works Co.... 45,521
Beds, Foster Bros. Mfg. Co.... 45,483
Beds, couches, divans, and bed bottoms, National Spring Bed Co.... 45,636
Beer, bottled lager, H. Koehler & Co.... 45,510
Blood purifiers, remedies for female complaints, and liver pills, Lydia E. Pinkham Medicine Co.... 45,450
Books and writing paper, blank, National Blank Book Co....45,601, 45,602
Boots and shoes, leather, L. A. Crossett.... 45,588
Boots and shoes of leather and of leather and cloth, A. E. Little & Co.... 45,539
Bricks, clay fire, McLeod & Henry Co.... 45,648
Brooms, D. Fink.... 45,621
Buttons, pearl, Nord-Buffum Pearl Button Co.... 45,507
Calcium chlorid, Solvay Process Co.... 45,444
Candy, Gibbs Preserving Company of Baltimore City.... 45,577
Candy, popcorn, Gibbs Preserving Company of Baltimore City.... 45,576
Canned fruits and vegetables, Bloomington Canning Co....45,569, 45,570
Carriage bolts, Russell, Burdsall & Ward Bolt & Nut Co.... 45,460
Caviar, canned, pickled, and smoked fish, Hansen & Dieckman.... 45,511
Chocolate, Walter Baker & Co.... 45,580
Cigars, T. H. Hart & Co.... 45,558
Cigars, F. R. Rice Mercantile Cigar Co. 45,559, 45,560
Clocks, A. Y. Jansen.... 45,594
Coats, vests, trousers, and overcoats, mens, Strouse & Bros.... 45,524
Coffee containing Java and Mocha, blended, E. T. Smith Co.... 45,542
Collars and cuffs, Earl & Wilson.... 45,582
Cologne water, Florida water, and perfumery, Mulhens & Kropff.... 45,617
Concrete constructions and parts connected therewith, rein-forcing frames for, Unit Concrete Steel Frame Co.... 45,648
Conductors or cables, woven covered, F. M. Ferrin.... 45,491
Confections and bonbons, chocolate, H. D. Foss & Co....45,578, 45,579
Corsets, Warner Bros. Co.... 45,584
Cotton piece goods, F. Ostrander.... 45,532
Cough syrup, E. C. De Witt & Co.... 45,448
Crucibles, Bridgeport Crucible Co.... 45,628
Disinfectants, Read Holliday & Sons.... 45,478
Dolls, Cole-Ackerman Co.... 45,593
Ducks, P. McEvoy.... 45,591
Electrical switches, automatic circuit and automatic magnetic circuit breakers, automatic, Cutter Electrical & Mfg. Co.... 45,462
Fabrics, bleached, unbleached, printed, and dyed textile, Eddystone Mfg. Co.... 45,540
Feed water heaters, Warren Webster & Co.. 45,639
Fertilizers, artificial or manufactured, Imperial Co.... 45,652
Files, D. B. Murphy File Co.... 45,457
Flavoring extracts, fruit syrups and juices, McCormick & Co.... 45,575
Flour, Galesville Milling Co.... 45,562
Flour, wheat, Hungarian Milling & Elevator Co.... 45,493
Flour, wheat, T. C. Jenkins.... 45,494
Flour, wheat, T. C. Brunner.... 45,495
Flour, wheat, J. R. Willcox.... 45,496
Flour, wheat, Phoenix Flour Mills.... 45,497
Flour, wheat, Missouri Valley Milling Co.... 45,498
Flour, wheat, Hungarian Milling & Elevator Co.... 45,499
Flour, wheat, Crescent Mill & Elevator Co. 45,561
Flour, wheat, G. C. Christian & Co.... 45,563
Flour, wheat, Mayflower Mills.... 45,564
Flour, wheat, Missouri Valley Milling Co....45,565 to 45,567
Flour, wheat, Sleepy Eye Milling Co.... 45,568
Furniture polish, Cedarine Allen Co.... 45,613
Games, A. W. and E. A. Loss.... 45,592
Garments, such as coats, vests, and trousers, men's outer, Steefel, Strauss & Connor.. 45,531
Gelatin and compounds of gelatin, Plymouth Rock Gelatine Co.... 45.574
Gelatin, phosphated preparation of, Plymouth Rock Gelatine Co.... 45,573
Gin, Bluthenthal & Bickart.... 45,504
Gin, S. & S. H. Freiberg.... 45,547
Glass chimneys, lantern globes, and reflectors, Gill Brothers Co....45,622 to 45,627
Graphite, graphite paint, and graphite electrodes, International Acheson Graphite Co.... 45,608
Guns and parts thereof, Hunter Arms Co.... 45,488
Hair in natural waves, fluid for training the, C. E. Wurtner.... 45,481
Hair tonics and shampoos, M. E. Mullen.... 45,480
Harmonicas, mouth, C. Bruno & Sons.... 45,629
Hose supporters, George Frost Co. 45,526, 45,527, 45,586, 45,587
Hosiery, Mascot Knitting Mills.... 45,530
Hosiery, F. Victor & Achelis.... 45,583
Impression and molding compounds, S. S. White Dental Mfg. Co.... 45,482
Ink, black, Thaddeus Davids Co.... 45,605
Ink, indelible, Thaddeus Davids Co.... 45,604
Inks, printing and lithographic, Charles Eneu Johnson & Co.... 45,606
Insulators, electrical, American Mica Co.... 45,644
Jackets, suits, capes, dresses, dress skirts and waists, ladies' and misses', Prints Biederman Co.... 45,528
Knives, machine, belt and leather, Bailey & Blendinger Mfg. Co.... 45,486
Lamp chimneys, Gill Brothers Co.... 45,484
Laxative for stomach and liver troubles, Foley & Co.... 45,449
Leather, boots, shoes, harness, rubber, and cloth, dressing for, A. E. Little & Co.. 45,609
Leather polish, Whittemore Bros. & Co....45,610 to 45,612
Lotion, C. W. Holmes.... 45,616
Matches, Pennsylvania Match Co.... 45,620
Medicinal cordial or liquor, C. Xander.... 45,544
Medicinal tablets, Antikamnia Chemical Co.. 45,445
Mineral waters, White Rock Mineral Spring Co.... 45,542
Molasses, Eastern Refining Co.... 45,463
Molasses, Boston Molasses Co.... 45,571
Nails provided with a non-metallic coating, J. C. Pearson Co....45,458, 45,459
Oil cloths and linoleums, Thomas Potter Sons & Co.... 45,533
Oil, illuminating, Republic Oil company.... 45,518
Oils, automobile, gas engine, and marine engine, W. S. Sheppard.... 45,640
Oils, illuminating, Jenney Mfg. Co.... 45,513
Oils, illuminating, Valvoline Oil Co.... 45,515
Oils, lubricating, Union Petroleum Co. 45,516, 45,517
Organs, reed, Cable Co....45,630 to 45,632
Paper and envelopes, writing, Merriam Paper Co.... 45,600
Paper, tinted blotting, District of Columbia Paper Mfg. Co., Washington, D. C.... 45,503
Paper, toilet, Scott Paper Co.... 45,508







Paper, writing, Whitaker Paper Co. .45,500 to 45,502
Pencil and cleaning composition erasers, F. A. Weeks 45,607
Perfumes and toilet water, Mulhens & Kropff. 45,479
Periodical, printed, Farm Poultry Publishing Co. 45,485
Petroleum or coal oil for illuminating purposes, refined, Waters Pierce Oil Co.... 45,520
Pianos, Cable Co. 45,634, 45,635
Pigments, Semet-Solvay Co. 45,615
Pills, J. M. Sharp 45,475
Plows, harrows, and cultivators, Gale Mfg. Co. 45,487
Ranges, stoves, and heaters, Majestic Mfg. Co. 45,638
Razors, J. Curley & Bro. 45,456
Razors, safety, J. Curley & Bro. 45,455
Refrigerators, Maine Mfg. Co. 45,637
Remedies for dyspepsia, L. E. Cash 45,470
Remedies for dyspepsia, E. C. De Witt & Co. 45,473
Remedies for indigestion, Churchill Chemical Co. 45,471
Remedies, laxative, L. Prange 45,452, 45,453
Remedy for coughs, colds, croup, bronchitis, and lung troubles, Capudine Chemical Co. 45,469
Remedy for diseases of the hair and scalp, Herpicide Co. 45,474
Remedy for diseases of the stomach, liver, kidneys, and bowels, D. J. Clarke 45,446
Rivets, tubular, solid, and pronged, Tubular Rivet & Stud Co. 45,490
Roofing felt and tarred roofing paper, sheets and rolls of, New England Felt Roofing Works 45,646
Salve, G. P. Olsen 45,451
Salves, soft salves, ointments, or unguents, J. W. Cole & Co. 45,472
Seed, grass, E. W. Conklin & Son 45,651
Sheetings and drills, Brandon Mills 45,525
Shellac, gum, Rogers & Pyatt 45,519
Shellac-varnish and gum shellac, Rogers & Pyatt 45,614
Shells and cartridges, shot, Winchester Repeating Arms Co. 45,512
Shirt waists, dress shirts, collars, and cuffs, S. L. Munson 45,583
Shoes in a fixed position while being cleaned and polished, devices for holding, A. J. Skinner 45,461
Shoes, leather, Hennessy Mercantile Co. .45,589, 45,590
Shoes, women's, misses', and children's leather, Smith-Briscoe Shoe Co. 45,529
Skirt and dress bindings, facings, and braids, Stewart, Howe & May Co. 45,538
Soap, bar, Schaeffer Bros. & Powell Mfg. Co. 45,619
Soap, liquid and powdered, E. L. Post 45,618
Soap, sponge, toilet paper, towel, bottle, brush, etc., holders, Searls Mfg. Co. ... 45,642
Stay tape, Reversible Collar Co. 45,536, 45,581
Sugar, syrup, and molasses, Siegel, Copper & Co. 45,572
Syrups, molasses, and sorghum, New Orleans Coffee Co. .... 45,465 to 45,468
Teas, colored Japan, E. B. Millar & Co. 45,541
Thread, linen, cotton, and silk, Landis Machine Co. 45,534
Tiles and coverings for ceilings and walls and for other purposes, flexible, United Metile Co. 45,645
Tires, pneumatic, Continental Caoutchouc Co. 45,643
Tonic, L. A. Siebert 45,454
Trousers, Dutchess Mfg. Co. 45,535
Typewriter ribbons nad carbon papers, Carter's Ink Co. 45,603
Umbrellas and parasols, C. H. Namendorf .. 45,492
Watchcases and watch movements, Dueber Watch Case Mfg. Co. 45,596
Watches, parts of watches, and watchcases, American Waltham Watch Co. 45,595
Welding compound, chemical, Cortland Welding Compound Co. 45,476
Welding compounds, Cortland Welding Compound Co. 45,443, 45,477
Whips, Standard Whip Co. 45,641
Whisky, Thixton, Millett & Co. 45,505
Whisky, M. J. Bligh 45,506
Whisky, Taylor & Williams 45,507
Whisky, Old Grand-Dad Distillery Co. 45,508
Whisky, Danciger Bros. 45,509
Whisky, S. & S. H. Freiberg ...... 45,548 to 45,553
Whisky, Bluthenthal & Bickart 45,554, 45,555
Whisky, D. Sachs & Sons 45,516
Whisky, John Ellwanger Co. 45,557
Whisky, rye, James Clark Distilling Co. 45,503
Wine, Empire State Wine Co. 45,545
Wine, sherry, I. Kind 45,546
Woods as a raw material and as prepared for use in the manufacture of lead pencils, pine, cedar, and similar, Germania Cedar Co. 45,650
Yarns, woolen threads, Shetland floss, etc., Calhoun, Robbins & Co. 45,537

LABELS

"Amazon," for cotton twill goods, Wilson & Bradbury 12,342
"Badger Brand Full Cream Cheese," for cheese, Fond du Lac Cheese & Butter Co. 12,333
"Bain's Best B B Brand,' for macaroni, Bain Brothers Co. 12,334
"Bath of Flowers," for toilet powder, Cutonia Distributing Co. 12,327
"Bath of Flowers," for toilet powder, Davis Bridaham Drug Co. 12,328
"Black Hide," for cotton twill goods, Wilson & Bradbury 12,341
"Dicks Nox-All," for a cleaning preparation, Dickson Bros. 12,339
"Dr. Dicks Colic Cure," for colic cure, Dr. Dick's Malted Stock Food Co. 12,331
"Dr. Dick's Veterinary Salve," for salve, Dr. Dicks Malted Stock Food Co. 12,330
"Dr. Dick's Veterinary Soap," for soap, Dr. Dicks Malted Stock Food Co. 12,329
"Eccles' South African Liniment," for a medical preparation, T. Eccles 12,336
"Indian River Kidney Cure," for medicine, Christie-Groover Drug Co. 12,335
"Janarios," for cotton twill goods, Wilson & Bradbury 12,344
"Mackinaw," for cotton twill goods, Wilson & Bradbury 12,340
"Our Biscuit," for biscuits and crackers, Biscuit & Crackers Manufacturers Co. ... 12,332
"Pigeon Blood," for cotton twill goods, Wilson & Bradbury 12,343
"Rat Butter," for rat poison, W. Mallory .. 12,337
"Xpert Blue,' for bluing, Schoellkopf, Hartford & Hanna Co. 12,338

PRINTS.

"Autumn Back, Congress Playing Cards," for playing cards, United States Playing Card Co. 1,405
"It Will be Right There,' for breakfast food, Cream of Wheat Co. 1,401
"More," for breakfast food, Cream of Wheat Co. 1,403
"One of the 20," for borax soap, Pacific Coast Borax Co. 1,404
"The Beer that Made Milwaukee Famous," for lager beer, American Fine Arts Co. .. 1,400
"To Reach the Goal of Health," for breakfast food, Cream of Wheat Co. 1,402

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.